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A NOTE ON THE RELIGIOUS SIGNIFICANCE OF SCIENCE.

NO ONE who has watched thoughtfully the signs of the times can have failed to perceive that modern science both by the introduction of new materials of knowledge and especially by changing our point of view of nature and of human life, is rapidly transforming both our Philosophy and our Religion. The transformation is still going on and far yet from complete; and many fear that there is serious danger of its going too far. I wish to show that these fears are unfounded.

It is a trite remark that tendencies are apt to become fashions of the time, and, like fashions, are apt to run into extremes, and thus provoke reaction. Thus the course of progress of opinion has been likened to a swinging pendulum, which passes from one extreme to another, but with ever decreasing excursions, until it settles on truth. Or, again, to a rising spiral, returning ever upon itself, but gaining a little with each circle. Now, there can be no doubt that the most striking characteristic of modern times is the rapid advance of science, and therefore the most striking modification of the educational system is the increased introduction of scientific subject-matter, scientific ideas, scientific methods. This has led, in the popular mind, to a kind of glorification of science at the expense of other coördinate departments of intellectual pursuits, and has very rightly provoked some reaction among conservative

thinkers. Many thoughtful men are beginning to think that this apotheosis of science has already gone much too far in the popular mind, and therefore is likely to affect injuriously our system of education. Science is not only advancing with dizzying speed, but the scientific spirit and the scientific method are invading every department of thought, and claiming as her own everything in sight. There has arisen, therefore, in the conservative, and especially in the religious, mind a vague dread of the final result, not only on education, but on society itself. This danger-cry has found strong, though temperate and guarded, expression in the admirable address of Prof. Woodrow Wilson, at the sesqui-centennial celebration of Princeton in 1896. Now, I fully sympathise with Professor Wilson's view, and have myself on many occasions spoken as strongly as he; but I see clearly (as he apparently does not) that the cure for this disease, if it be such, must come from science herself. I will, therefore, first put the trouble as strongly as I can and then show the only possible remedy.

Science is so recent and its course so rapid, there is such an accumulation of new material and such a fermenting of new ideas, that there has not yet been time enough for organisation into rational knowledge, which is philosophy. Intellectual food is gathered and ingested so fast that there has been no time for digestion, assimilation and incorporation into our essential human nature. Science is as yet a vast storehouse, a treasury of material, arranged, it is true, in orderly manner according to its own laws, but not yet according to the highest law, not yet brought into harmonic relation with our moral and æsthetic nature, and therefore not yet able to help to guide moral conduct, which is the true end of all knowledge. It must yet be incorporated into our innermost human nature, becoming bone of its bone and flesh of its flesh. It must disappear as mere external possession, and reappear as character and spiritual power, before its real beneficence can be felt. Now, as most people value more what they have than what they are, are vainer of possession than of character, of learning than of culture, it has come to pass that the age has become vain and boastful of scientific progress, and intoxicated with extravagant hopes of the

speedy advent of a society regenerated by science. These optimistic philosophers would, therefore, cut loose entirely from the past. They say: "Let the dead past bury its dead, but follow thou the light of living science." They would destroy utterly, raze to the very ground, the old in religion, in art, and especially in social organisation, and build again all these at once on a new basis and out of new scientific materials, which they themselves undertake to furnish. And these self-styled scientific philosophers and social reformers are so convinced in mind and positive in statement that they are impenetrable to any other view. Verily, we had supposed that dogmatism was the preëmpted right of theology; but if so, then these new scientific philosophers have certainly "jumped the claim."

I have put the case as strongly as I can. Now, the answer:

1. It is evident to the most casual observer that this intoxicating effect of science, with its accompanying vanity, boastfulness, and extravagant hopes, and mad rushing in where angels fear to tread, is not found among true scientific men, but almost wholly among the pseudo-scientific. It is not the legitimate offspring of the true scientific spirit, but is the effect of scientific facts on the unscientific mind. The true scientific spirit is characteristically modest and cautious even in her own domain, much more in that which lies beyond that domain.
2. It is often said that we are now in a transition state between the old and the new, and that transition states are always dangerous. Doubtless increasing knowledge is, indeed, unsettling, and to some weak spirits perhaps dangerous. But there is no other possible cure for this but more and still more knowledge. In this case, at least, the principle "*similia similibus curantur*" holds good. But knowledge is increasing now so rapidly that we shall always hereafter be in a transition state. The only permanent cure, therefore, is to be found in a rational spirit, which recognises and accepts eternal change by evolution as a law. The introduction of new knowledge, especially a great new idea like the law of gravitation or the law of evolution, necessitates a complete readjustment of our whole mental furniture to a new and higher order. But unfortu-

nately, the mental furniture of most persons is so screwed to the floor that it is impossible to readjust without tearing up the whole mental flooring. But let me not be misunderstood. There is also another extreme in this regard. Mental furniture must not be fixed indeed; but neither must it be too movable. It must not be screwed down indeed; but neither must it be set on rollers.

But to return and put it another way: Certain general principles, beliefs, customs, etc., are necessary for effective social activity. But unfortunately these soon harden into an external shell of dogmas and creeds, and, with advancing progress, must be broken and thrown off. They are, first, necessary for activity, then helpful, then protective against dangerous changes, then finally obstructive of growth, and must be cast off. But, alas! society is left for the time in comparatively helpless condition for want of fixed general principles of action. New beliefs, new principles of activity, are soon formed; but again only external to the living spirit. These are speedily hardened again, and must in their turn be broken and cast off, and so on apparently indefinitely. To illustrate: The social organism has heretofore been and is now constructed on the plan of the crustacean. Its skeleton, its instruments of activity, are on the outside, enclosing and protecting all the vital parts. But life is conditioned on continuous growth. In this contest between interior growth and restraining shell, the latter must be broken and cast off, and then we are left in a helpless, soft-crab condition. Soon the crust hardens again into a firm skeleton, and efficient activity is regained, and perhaps more effective than before. But, interior growth continuing, the moulting must be repeated, and with it again the same helpless condition.

And must this go on forever? Must there not come a time when a rational philosophy shall prevail? Shall there not come a time when the social organism shall be constructed on the plan of the vertebrate instead of the crustacean, with the skeleton within, in eternal ethical principles, instead of without, in dogmas and formulas; and the exterior, with its customs, habits, forms of belief, etc., shall be left plastic and yielding to interior growth, sensitive to all external influences, and receptive of all new knowledge?

If so, then from that time forward growth will become steady, and no longer by a succession of catastrophies.

3. I said the final and permanent cure for the evils of society is the advent of a true rational spirit; and this will come with increasing knowledge. Now, nothing, I am convinced, will so contribute to the formation of this rational spirit as the clear and thorough apprehension of the idea of Evolution. The supposed dangers and evils coming from the dominance of the scientific spirit is completely cured by this youngest child of the marriage of Science and Philosophy. I say thorough apprehension, because it is this very idea that is supposed by superficial thinkers and pseudo-scientists to give reasonableness to their revolutionary views. It is this very idea which is most dreaded by ultra-religious conservatives.

I said the evils complained of will be cured by the idea of evolution. Let me explain: Professor Wilson says "science breaks with the past." Evolution, at least, cannot break with the past. She, at least, cannot do without the past. The very definition of evolution is growth—not manufacture; growth of the present out of the past, and of the future out of the present. Evolution, at least, cannot say, "destroy the old, and build again at once out of new materials;" the fundamental principle of evolution is that nothing ever comes in that way. For example: In the geological history of the organic kingdom old forms die and new forms come in. But how? Not created at once out of hand. On the contrary, some old forms die out and leave no progeny; but some are transformed into the higher new, and—mark this—all the new forms come in this way only; i. e., by transformation of the old. The same is true also in the growth of knowledge and in the growth of the social organism. In the evolution of knowledge new ideas and new theories take the place of the old, but not made out of wholly new material. On the contrary, some old ideas die out, and leave not a wrack behind, and some are transformed into the higher new, but all the new come only by modification of the old. In the evolution of society we see the same law. Some forms of social organisation and some institutions die out and leave no progeny, and some are transformed into the higher new. But all the higher new come not by

manufacture out of new material, but only by transformation of the old. Strange that these objectors to science as destructively revolutionary, and especially strange that Professor Wilson, a teacher of history, should not see this. For what is the so-called historic method but the evolution-method imported into the domain of social progress?

In conclusion, I am convinced that nothing so tends to generate a rational spirit—which is the only ground of safety to society—as the idea of evolution. It breaks down all hard and fast lines, and substitutes only gradations. It forbids all sudden creations at once out of the whole cloth, and substitutes only eternal growth. Dogmatism and partisanship cannot live in its presence, for it is the very spirit of tolerance in religion and in politics; not, indeed, the tolerance of indifference, but that of a true rational spirit. Both art and religion will be transformed by its genial philosophic spirit. When scientific facts and scientific ideas become, not alone an external possession, but assimilated, incorporated, as it were soaked in and made an integral part of our common human nature, then will they be taken hold of by the creative imagination, and there will arise a greater art than ever before. When beliefs and principles of action are vivified by reason, and become a common heritage of humanity, then shall we all rise to a higher plane of religious thought than ever before. Science has come, not to destroy, but to fulfil and verify all that is best and truest in our faiths and aspirations, and thus to purify and ennable both art and religion.

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already written, and that, as I have already written, in
it, I have not only laid down a few general principles, but I have also
endeavored to give a detailed account of the
various properties of the nerves, and of the
various forms of nerve-activity. I have also
endeavored to show that the properties of the
nerves are not to be attributed to the
nerves themselves, but to the
multifarious aggregate of
conditions which surround them.

ON THE THEORY OF NERVE-ACTIVITY.¹

"A THEORY of nerve-energy would have to show how precisely
those properties which are characteristic of the activity of
the nerves result with necessity from the multifarious aggregate of
the conditions constituting them."

I have taken these words from the *Manual of Physiology* of Carl
Ludwig,² that memorable man, who achieved so much for physiol-
ogy during his long connexion with the university of Leipsic. And
now that I am about to develop a special view of my own relating
to nerve-activity, it is both appropriate and requisite that I should
apply the criterion involved in Carl Ludwig's words to the theory
which I am to advance.

If I were asked whether this view could be considered as a
contribution to the theory of nerve-activity in the sense indicated
by that great master of experimental physiology, I should have to
confess that such is not the case; for neither from their constitu-
tion nor from their form can I deduce with necessity that property
which I am going to attribute to the nerves, however much I may
be inclined to assent to Ludwig's dictum "that a nerve is indebted
for its energy to its constitution and structure," and to a change in
those for a change in its energy.

The source from which I have derived my views relative to the
mode of activity of the nerve-fibers, lies quite remote from all the
knowledge we now have of their structure and of their chemical and

¹Academic Discourse delivered before the University of Leipsic, May 21, 1898.
The German original has just recently been published by Veit & Co. of Leipsic.

²Second Edition, page 141.

physical properties, and I am therefore perfectly willing that the view which I have put forward as a contribution to the theory of nerve-activity should be regarded only as a conjecture concerning the same.

In justification of my position, however, I may add that even at best we are in possession only of conjectures concerning the real inner nature of nerve-activity. We know, thanks to Helmholtz, that any sudden alteration in the condition of the nerve-fiber caused by some stimulus, is propagated along the fiber with a measurable speed, and further, how great this speed approximately is. But the exact nature of that alteration, and the exact character of the process propagated along the fiber, we do not know. Dubois Reymond's classical investigations have made us acquainted with the electro-motor property of the nerve in its various conditions. But as little as a galvanic current gives us an explanation of the peculiarities of the chemical process to which it owes its origin, so little does the current derived from a nerve give us information concerning the peculiarities of the chemical change in the nervous substance. The assumption that chemical phenomena are the gist of the process which we are wont to designate as the activity of the nerve, is, of course, more than a mere conjecture. But in making such a conjecture we assert concerning the nerve nothing more than what might just as well be asserted of all living substances. And nothing is said which would characteristically distinguish the life of the nerve from the life of any other organ.

In fact, life is still as much of an unsolved riddle as it was when the so-called mechanical conception of vital phenomena overthrew the vitalistic, and awakened by its brilliant achievements the most sanguine expectations, foreshadowing results far beyond what has even yet been fulfilled, valuable and fruitful as this has been.

To whatever point the physical or chemical investigation of the animal organism has penetrated, it has always, sooner or later, come upon the mysterious action of the living substance of those elementary organisms of which the animal and the human body are composed. We have now learned modesty, and from having once believed that we had entered the holy of holies, we now acknowl-

edge that we have as yet scarcely passed the portico of the temple. Can it surprise us then that to-day the old fallacious doctrine of vital force which we imagined had been definitively vanquished, should again rear its head under new names? Let us confess that we ourselves are to blame for this because in the first exultation of success we promised more than we were able to fulfil.

Let us cease considering physiology merely as a sort of applied physics and chemistry and thus avoid arousing the justifiable opposition of those who believe it to be an idle task to seek an exhaustive explanation of the living from the dead. Life can be *fully* understood only from life, and a Physics and a Chemistry which have sprung solely from the domain of inanimate nature, and which therefore apply solely to inanimate nature, are adequate only to the explanation of such things as are common to the living and the dead.

This is very much, but it is not all, and I am fain to paraphrase here the words of a brilliant physicist¹ who has used them in an analogous connexion, and say: If the assertion that physiology is only applied physics and chemistry be taken to mean that the laws discovered in the domain of physics and chemistry are sufficient without extension and generalisation to explain fully the phenomena of life, "we are, in my opinion, confronted with a view which is in every respect comparable to that of Thales, who endeavored to explain everything from the properties of water. Think of the improbability of a wide domain of experience being absolutely exhausted by a narrower previously known one." If everything that took place in nature could be designated outright physical or chemical, whether it was subsumable under the present known laws of physics or chemistry or not, then naturally all phenomena of life would in such a case fall within the domain of physics and chemistry. But we cannot hoist our flag over a territory where we have never as yet set foot, much less explored.

At bottom, it was not the mere negation of vital force at this juncture that secured for physiology its brilliant successes, but rather, the concomitant introduction into biology of the rigorous

¹ E. Mach, *Die Principien der Wärmelehre*, p. 351.

methods of physical science and of the great mass of apparatus and appliances which had been created by those methods; and only in so far as vitalism persisted in employing unproductive methods for treating biological problems did it do real harm and was its overthrow of real benefit. In fact, every observed attribute of life which was susceptible of immediate physical explanation had already been physically explained in the heyday of vitalism. The laws of the lever had been applied to the movement of the human members, and the movement of the blood had been attributed to the contraction of the muscles of the heart, even at a time when the muscular activity itself was still conceived in characteristically vitalistic fashion. Even to-day we cannot explain this last-named activity, although it is one of the most palpable and most obtrusive of the actions of living things.

The impulse to resort to analogy and to carry over propositions abstracted from one domain into others is so great that there can be no fear that any phenomenon of life will long remain exempt from physical or chemical explanation after physics and chemistry have supplied the requisite means. To-day, the danger of precipitate and therefore of insufficient physico-chemical explanation of vital phenomena is perhaps greater than the danger that vital force should continue to be employed (to use a celebrated saying) "as the comfortable couch where reason is quieted upon the pillow of obscure qualities."

Even the mechanical theory of life has not been able to prevent the substitution of a new dogmatism for the old vitalistic creed, and in adducing a striking instance of this fact I reach the real subject of my present discussion.

I have already stated that the process which is propagated along a nerve-fiber in the shape of a so-called excitation is in its real nature unknown to us. Nevertheless, it is accepted as an established fact by most physiologists to-day that this excitation is always of exactly the same kind, not only in one and the same nerve-fiber but in all nerve-fibers; and that it can consequently undergo alteration only with regard to the strength and time of its

propagation, but not as regards its quality; and that, therefore, all functional differentiation of the nerves is exclusively resident in either their central or their peripheral terminal apparatus. So thoroughly convinced are many physiologists of the truth of this view, that they absolutely refuse to consider any theory which assumes a qualitative variability in the excitations which pass through the nerve-fibers. And they do this in the consciousness that they are supported by the authority of a Helmholtz, a Dubois Reymond, and a Donders.

But let us examine for a moment the meaning of the assertion that the excitations are absolutely alike in all nerve-fibers.

If it were possible to insert a portion of a sensory nerve into the path of a motor nerve, and to connect the former with the latter, fiber for fiber, a cerebral excitation of the motor nerve would pass unaltered through the inserted piece of sensory nerve to the muscle, which it would forthwith set into activity. Or, if we could cut out a piece of the optic nerve and insert in its place a piece of a motor nerve, and combine every fiber of the former with every fiber of the latter, functional continuity would be restored along with the anatomical continuity, and the perception of light and color would be possible, just as before.

Finally, let us imagine the optic nerve and the auditory nerve severed, and each brought into conjunction with the other cross-wise. According to Dubois Reymond, we should in such a case hear the lightning with the eye as a noise, and see the thunder with the ear as a succession of light-impressions.

Of such a character are the consequences that flow from the assumption that the functions of the nerve-fibers are all absolutely alike. The impossibility of actually realising the hypothetical cases which have been adduced affect in no wise the correctness of the conclusions drawn from them.

What, now, are the considerations that could have lead to the enunciation of so definite an opinion regarding processes which are still involved in so much mystery for us? Carl Ludwig himself once considered the question of the likeness or unlikeness of the

nerve-fibers, and did so with all his wonted caution, but he finally left the question undecided, as did also Johannes Müller in his time. Since then, no new facts have been brought to light which could have tended to confirm the theory of the homogeneity of the nerve-fibers, as Ludwig called it. For the experiments on the grafting of the peripheral terminals of severed nerves, with the central terminal of a nerve having different functions, even if they had been successful, could not have decided our question. And yet, by the majority of physiologists the theory of homogeneity is regarded to-day as an established truth.

By his *Investigations in Animal Electricity* Dubois Reymond¹ believed he had "awakened into lifelike reality the hundred years' dream of the physicists and physiologists regarding the identity of nervous energy and electricity, even though in a slightly changed form." The facts which he adduced have been confirmed in all their essential points, and although their interpretation has turned out to be different from what he conjectured, yet the opinion which he cherished, according to which the essential nature of nervous activity found its expression in electrical phenomena, is still shared by many physiologists to-day. Now this view was in its time, and to-day is, so far as I can see, the principal foundation of the conviction which so generally obtains in the scientific world regarding the homogeneity of the nerve-fibers and of their excitations.

When we set a nerve in excitation at any point of its course by an artificial stimulus, the propagation of the process of excitation can be followed step by step along the path of the nerve by means of a galvanometer, for the reason that the electric behavior of the nervous substance changes precisely as the condition of the nervous substance itself changes in passing to the excited state. The galvanometer then shows us the current of action, or at the severed terminus of the nerve the so-called oscillation of the current of injury. It was rendered highly probable by Dubois Reymond (and later investigations have only confirmed the conjecture,) that these electrical phenomena are characteristic of all nerves, and that

¹ Preface, p. 15.

they accompany not only the excitations which have been produced by artificial stimuli, but also such as are disengaged in the natural way from the central or peripheral terminal apparatus of the nerve-fiber. If now the electric phenomena were the expression of the real inner character of the excitation passing along the nerve, the homogeneity of the latter would follow immediately from the homogeneity of the former; and different nerve-fibers could exhibit different behaviors only with regard to the intensity and time of action of the excitation.

It was afterwards discovered that the electric phenomenon in question admitted of scarcely any other explanation than that of a chemical process propagated along the excited nerve. Yet even this discovery could not shake the theory of homogeneity.

After that theory had once taken root, the identity of the chemical process was deduced immediately from the identity of the electrical behavior, and the idea never suggested itself that we might with just as good reason infer the identity of two chemical processes from the identity of their thermal effects, or the identity of the chemical transformation in two galvanic elements from the identity of their currents.

The electrical phenomena which accompany the excitation of the nerve furnishing no adequate foundation for the theory of homogeneity, the next natural support likely to be resorted to for this theory is that of the morphological and chemical homogeneity of the nerve-fibers. It is quite true, we are as yet unable to distinguish by the microscope and by chemical reactions every motor fiber from every secretory fiber, and every optic fiber from every auditory fiber. But the cases are numberless in which living elementary structures having different functions exhibit absolutely the same behavior when subjected to known optical or chemical tests.

The germs of quite different species of animals are frequently so much alike as to be confounded with one another; and the germs of different individuals of the same species naturally show a still greater degree of similarity. Yet no biologist has the least hesitation in ascribing to each individual germ some quite specific individuality, some personal idiosyncrasy, so to speak, of inward struc-

ture or molecular constitution by virtue of which a perfectly definite path of future development is marked out for it.

It is regarded as almost certain that the different functions of the secretory cells of the various glands are attributable to the physical and chemical differences of their vital substance, and yet in many cases it would be quite impossible by the microscope and micro-chemical methods at our command, to determine the actual function of any single glandular cell.

It was shown by Max Schultze many years ago, and recent inquiries have confirmed his results,¹ that while the pseudopodia of the same rhizopod merged and fused perfectly on contact, the pseudopodia of different individuals of the same species would not fuse on being brought together. Now, if the protoplasm of two individuals of the same species were absolutely of the same composition, it would be difficult to see why their pseudopodia should not behave with regard to one another precisely as the pseudopodia of the same individual do.

We are obliged, accordingly, to attribute to the living substance of every single one of these minute and inferior creatures, specific individual properties, by virtue of which their substance is distinguished from the substance of every other individual of the same species; although there cannot be, even in so patent a case as the present, the remotest thought of directly demonstrating these inferred differences by the experimental means of investigation at our command.

But if a distinctive individual stamp must be imputed to every one of the countless members of the same rhizopod species, why shall some such distinctive mark be refused to the elementary organisms of which the nervous system is composed? The fact that the rhizopods lead an independent life, while the nerve-elements are rigorously subordinated parts of a more highly developed organism, is no reason whatever for our not doing so, seeing that each individual nerve-fibre is connected with a vast and most varied host of

¹ Paul Jensen, "Ueber individuelle physiologische Unterschiede zwischen Zellen der gleichen Art." *Pflüger's Archiv für die ges. Physiologie.* Bd. LXII., p. 172. 1895.

vital functions, and that consequently it can according to the principle of the division of labor be highly differentiated; whereas no such division of labor can come into consideration in the case of the individuals of a rhizopod species.

In this division of labor of our organism lies, in fact, part of the answer which I should give to the advocates of the theory of homogeneity, if they were to ask why I am anxious to assume heterogeneity in places where the assumption of homogeneity appears to be adequate to explain the function of the nerve-fibers as simple organs of conductivity. The argument that I have adduced, they would contend, proved at most that the sameness of all the fibers cannot now be directly demonstrated, that there are even reasons for suspecting them to be not the same, but that in any event no counterproof to their theory is furnished. Even the wires which conduct electricity, they would say further, may be put to very different uses, and yet the electrical phenomenon in the conducting wires is qualitatively the same. The fact that the excitation of a glandular nerve produces a secretion, while that of a muscle-nerve produces a movement, is sufficiently explained by a difference in the terminal apparatus upon which those nerves act; and just so much ground and no more is there for supposing a qualitative difference of excitation to result from a difference in the stimuli by which the nerves of the several sense-organs are excited. The further fact, they would continue, that sound is able to excite the auditory nerve and light the optic nerve is due entirely to the different structure of the apparatus at the peripheral end of these nerves,—one apparatus being especially adapted for the reception of sound-waves and the other for the reception of light-waves and for their transformation into nervous excitation. If the sound were to strike directly upon the auditory nerve itself, and not on the peripheral apparatus, if the light were to fall directly upon the optic nerve itself, these nerves would not be excited,—a proof that the so-called specific excitability of the various sensory nerves is not due to any dissimilarity of the latter, but entirely to the differences of the terminal apparatus which receive the impression.

In answer to this oft-repeated argument, it must be frankly

confessed that so far as our present knowledge goes, no conclusion whatever follows from the varying behavior of the sense-organs toward different sensory stimuli in favor of the assumption of a specific heterogeneity of the sensory nerve-fibers; but neither does anything follow in contravention of such an assumption. And it must be further admitted that considering the dissimilarity in results which follow upon the excitation of nerves that act centrifugally according as they set a muscle or a gland in activity, no conclusive argument is forthcoming either in favor of or in contravention of the homogeneity of these nerves.

But the situation assumes a different aspect when we consider the manifold results to which the excitation of such sensory nerves leads as have not their terminus in such heterogeneous organs as the muscles or the glands, but all end in the brain. For instance, we are compelled to inquire how it is that the excitation of one nerve brings with it the sensation of light and color, that of another the sensation of sweet and sour, that of a third the sensation of heat and cold, while at the same time all these nerves carry to the brain excitations which are absolutely the same in quality. To this the theory of homogeneity has always answered without the least ado that it is because the like nerve-fibers of the tongue and of the eye lead to unlike nerve-cells in the brain, some of them to cells whose specific character enables them to take up the excitatory conditions that correspond to the sensations of taste, others to cells which conformably to their specific function respond to the excitation of the fiber with precisely that physiological process whose psychical correlate is a sensation of light.

And here finally we are met with the frank concession that that interior commotion of the nervous substance which we call excitation or activity is, at least in the various sensory centers of the brain, specifically differentiated, and that here at last the functional homogeneity reaches its termination.

While this doctrine was taking its development,—a doctrine according to which all the nerve-fibers are exactly the same in kind, but the terminal apparatus which are functionally connected with

them are different in kind,—the idea necessarily suggested itself of separating the nerve-fibers as a particular group of elementary structures from the nerve-cells; but, even at the period of the development in question, it would have been quite admissible, in view of the anatomical continuity which had been established in numerous instances between cells and fibers, to have inquired by what right physiologists ascribed to the cells functions which varied in character, whereas they denied to the fibers connecting them all specific dissimilarity whatever, and that they did so in spite of the fact that chemical and physical research had not been able to discern any more characteristic differences in the substance of the cells than it had in the axial cylinder of the fibers.

Since that time, a different conception of the elementary structures of the nervous system has found almost universal acceptance. Every nerve-fiber, according to this theory, is associated in such wise with a nerve-cell as to form with it a single elementary organism only; and the living substance of that organism, which is collected in more abundant quantities about the nucleus of the nerve-cell, is continued into the fibers. Accordingly, the nerve-fibers would be integral constituents of these elementary structures of the nervous system, or *neurons*, as they are called. On this theory, the idea is quite natural to ascribe to the fibers which continue the cells the same specific differences which physiologists were obliged to assign to the nerve-cells of the various cerebral centers.¹ But as soon as we do this, we no longer have before us cells which, though capable of performing different tasks, are yet connected by filaments having quite the same functions, but we have elementary organisms whose specific or individual dissimilarity extends to their remotest filar prolongations. A nerve-trunk is no longer a mere bundle of conducting wires disengaging different sorts of effects according to the kind of apparatus with which they are connected at their termini and being at the same time in their own specific function absolutely of the same kind; but it is a bundle of living

¹ I offer no opinion as to the correctness of the histological doctrine of neurons. I lay it at the foundation of the present discussion because my theory needs some definite histological substratum.

arms which the elementary organisms of the nervous system send forth for the purpose of entering into functional connexion with one another, or of permitting the phenomena of the outside world to act upon them, or of exercising control over other organs like the muscles and the glands. And in each one of these arms a quite special kind of life is active, corresponding precisely to the neuron to which the nerve-fiber belongs. The conducting path which unites a sense-organ with the cerebral cortex, or the latter with a muscle, appears as a chain of living individuals of which every member, although always dependent upon its neighbors, still leads a separate life, the specific character of which is generally different in the different parts of the nervous system. Even in the neurons of the same group it is not absolutely the same, but bears in each of them a more or less individual stamp.

The theory of the homogeneity of the excitatory process in all the nerve-fibers involves the further assertion that this process remains qualitatively the same in one and the same fiber, and that it is variable only as to intensity and time of propagation.

I once advanced views relating to the processes in the nerve-apparatus of the visual organs which presupposed that in one and the same retinal element different processes could be set up by light-waves of different rates of vibration. The physiologists declared such a view inadmissible inasmuch as more than one process in the same structural element would presuppose more than one conduction-process in the corresponding fiber, a view which physiology was forthwith compelled to repudiate.¹ And this dogma, according to which every nerve-fiber is held to be capable of only one kind of excitation, had actually been extended also to the nerve-cells. True, as already said, physiologists were even then compelled to ascribe to the nerve-cells of the different sensory centers different functions; but in one and the same cell the excitation was said to be of unalterable quality.

It was no less an authority than Helmholtz who introduced this

¹ Donders, "Ueber Farbensysteme," *Arch. f. Ophthalmol.*, XXVII. 1881.

conception into the physiology of sensation, and to-day his disciples still esteem the doctrine of cerebral cells sensitive only to red, green, or violet, as the rarest fruit of Johannes Müller's doctrine of the specific energies of the sensory nerves. But I am convinced that Johannes Müller would not have accepted such a view, for his conception of biology was thoroughly monistic, and he would not have denied to the cell of the brain what must be conceded to the lowest unicellular organism, namely a more or less wide qualitative variability of its inner life.

Who can deny that the chemical changes in the substance of an infusorian vary qualitatively according to the changes in its external life-conditions; for example, in food material, or in other stimuli acting upon its body? And even granting that the progressive division of labor which accompanies the increasing structural complexity of the animal organism, in general brings more structural uniformity into the life of the individual cells, still there is no ground for the view that just in the nerve-cell this uniformity can become as complete as the homogeneity theory demands.

Granting, however, the possibility of qualitatively different excitation-conditions in the same cell (and in the fiber springing from it), then there is opened for the theory of nerve-life a series of points of view which are quite excluded by the homogeneity theory.

At the outset it follows that a neuron which is capable of various kinds of activities, will possess a correspondingly complex excitability, that is to say, it will vary in its reactions according to the nature of the stimuli, it will respond by one or another of its habitual special activities; in brief, the activity of the neuron and of its fiber may vary, not merely, as has been supposed, in intensity but also in quality, according to the nature of the stimulus, whether this be exercised by an external sense-organ, or by an adjacent neuron. A further consequence of our view would be that the effects in those non-nervous elementary organs with which centrifugal fibers stand in functional connexion, might also vary with the kind of excitation conducted in the fiber.

For the motor fibers, of course, there is, owing to the uniform

action of the muscle-fiber, no apparent reason for such a view. It is otherwise, however, with the nerve-fibers which govern the activity of a gland. The view now generally accepted is that, in conformity with their unalterable homogeneity of excitation, these secretory fibers can influence the activity of their dependent gland-cells only quantitatively. But how would it be if, according to the nature of the excitation given by the nerve-fiber, the chemical processes in the secretory cells were different, and consequently the nervous system could affect, within certain definite limits, the *quality* of the secretion furnished by one and the same cell?

And would not similar views hold in regard to the so-called trophic activities of centrifugal nerves? Inasmuch as these activities do not, as in the case of the motor or secretory nerves, immediately reveal themselves by easily demonstrable movements, they have hitherto remained rather within the domain of conjecture than in that of safely ascertained facts. If, however, the nervous system exerted an immediate influence, not merely on the motor and secretory, but also on the other elementary organs of the body (e. g., on certain epithelia, on the developing cells of the ovary, etc.), then here too the answer to the question whether such an influence were variable only according to quantity or also according to quality, would be of far-reaching influence.

But let us turn back to the activities which the excitation of a neuron exercises on those other neurons with which it is connected.

If, as histology teaches us, a sensory fiber entering the spinal cord divides into an ascending branch and a descending branch, and from these latter there branch off the so-called collaterals which finally stand in relation with other neurons (it matters not whether through direct contact or through connection); if finally every one of these neurons by its branching stands in functional relation with still others, and so on; then, from a purely anatomical standpoint, there exists for an incoming excitation an incalculable multiplicity of paths through the central nervous system. If now an excitation which has seized a neuron, should pass on indifferently to all the other neurons with which the first is functionally connected, there

would result an exceedingly wide-spread diffusion of the excitation entering through a sensory fiber or coming from a neuron to the cerebral cortex, a diffusion such as is not known to exist, or, at the most, is only approximated to in motor effects under pathological conditions.

It must consequently be assumed that the excitation of a fiber does not take indifferently all the anatomically given ways, but selects predominantly certain determined paths, diffusing itself in the others only in a more or less enfeebled manner or only exceptionally; and the question hence arises: What is the determining factor for this choice, and for the varied ratio of the strengths with which the excitation propagates itself along the many possible paths?

The homogeneity theory finds the answer in the different degree of excitability and conductivity of the individual paths, and in the different amounts of resistance offered to passage from one neuron to another. As for the further diffusion this is made to depend entirely on the strength of the incoming stimulus.

Numerous facts from the sensory and motor territories of nerve-life teach us that the innervation issuing from a neuron can diffuse itself in the nervous system very differently according as certain other excitations take place at the same time. For example, though the stimulus be the same, a reflex movement is sometimes reinforced and sometimes inhibited by excitations issuing simultaneously from another place on the periphery of the body or from the brain. Accordingly, the homogeneity theory accepts the view that resistance to conduction in a neuron can sometimes be increased and sometimes lessened by excitations which reach the same neuron from another direction, in other words that sometimes a so-called path-breaking, sometimes an arrestation takes place; but it does not further explain how excitations which are said to be always of the same kind and to differ only quantitatively, can at one time operate on the neuron so as to promote, and at another time so as to arrest, its function.

Everything is seen in a different light, however, as soon as a qualitative variability of the conducted excitation, and also a quali-

tatively different excitability of the conducting paths, are admitted. If the individual nerve-fiber is suited for the taking up and transmission of definite qualities of excitation, either preferentially or exclusively, then the path which is taken by an excitation is coincidentally determined by the quality of that excitation.

As a report is principally taken up and circulated by those who take a special interest in it, that is to say, the paths of its spreading depend on the nature of its contents, so to a definite afferent excitation those neurons will react preponderatingly whose peculiar nature precisely corresponds to that excitation.

The mutual relations of neurons will then depend not merely upon their anatomical arrangement, but also on their degree of internal structural affinity. And as one and the same fiber need not be adapted merely to one kind of excitation, but may be adapted to a certain number (though within a narrow range), so not only will the same path be able to conduct various kindred qualities, but the excitation issuing from the same neuron will be able, according to its particular quality, to penetrate various parts of the nervous system.

If, further, excitations should be simultaneously brought to the same neuron by two of its neighbors, then according to the homogeneity theory these excitations could on meeting only strengthen or weaken each other. According to our view, however, the two excitations could be of different kinds, and from their meeting in the same substance might originate a new quality, which would indeed be closely related to the two single excitations, but not like either.

And generally the whole life and being of the nervous system, its ontogenesis and phylogenesis, appear in a totally different light as soon as we give up the dogma of the absolutely homogeneous function of all nerve-fibers, and ascribe to the individual fiber-groups and fibers specifically or individually different biologic characters. For that dogma excludes from the neuron every capability for development and improvement, in so far as such capability is not already inborn and in so far as it is not a mere augmentation

of its excitational or vital process, which latter is from the beginning to the end of its life supposed to be peculiar and unalterable.

Rightly have the opponents of the doctrine of the specific energies of the sensory nerves pronounced against the view of a life-long unalterable constancy of function of the nerves, but they went, as I conceive, too far when they contested the congenitally different and special nature of the individual sensory nerves, accepted the indifference of function of all sensory fibers of the new-born, and regarded all functional differences of nerve-fibers, which are the phylogenetic acquisition of innumerable generations, merely as the result of an adaptation to heterogeneous, individual sensory stimuli during the post-embryonic period.

Of course after birth the influences of the external world belong to the conditions of the further normal development of the whole body, and the sensory stimuli especially are indispensable conditions of development of the nervous apparatus of our sense-organs. But light, for example, finds in the eye of the new-born babe not a nerve-substance from which, so to speak, anything whatever can be made; in other words, a substance which, if it could be transposed from the eye into the ear or into the tongue could be educated by the sound-waves to be a medium of auditory sensations, or by gustatory stimuli to be a medium of taste-sensation.

As the germ sprouting from the earth needs light to become a green plant, so in the new-born babe the neuron in the eye needs light, and the neuron in the ear the sound stimulus, to complete its course of development; but just as light never makes the fungus green, so it could never make the neurons of the ear see if they should be transplanted into the eye. As I take it, the neurons of our eye are not merely *educated*, but are *born* for seeing, and likewise those of our ear for hearing.

This, however, does not exclude the fact that, within their own narrow congenital limits of existence and action, they are capable of further individual development. And the same holds good (sometimes more, sometimes less so) of all parts of our nervous system. It is true, the farther back in the immeasurably long developmental series of the animal organism a given part of it can

be traced, the more fast and sharp is the congenital stamp of its function, and the less capable does it appear of transformation and development in the course of its further life. But the cerebral cortex is reckoned among the phylogenetically youngest parts of our nervous system, and its neurons belong, as it seems, to those elementary bodily organs which in post-natal life are afforded the relatively widest sphere of individual action under the influence of impinging stimuli. Now, how is such a development conceivable if the internal activity of a nerve-fiber, or a nerve-cell, in brief a neuron, is to be always of one and the same kind?

What is it then that a neuron of our cortex under normal circumstances experiences? In other words, of what do the stimuli which encounter the same and determine its internal activities, consist? Under constant conditions of nutrition, these are mainly the excitations conducted to it from those other neurons which stand in relation to it by means of the nerve-fibers. If, however, these nerve-fibers always conduct to it only the same kind of excitation, have, so to speak, only one note to their lyre, and therefore the stimuli which the neurons experience throughout life are the same and are variable only in quantity and time, then the reaction of the neuron will also always be one of the same kind, and the afferent stimulus can only liberate in the nerve-cell forever *the same* activity. And if, as the homogeneity theory concedes, the latter could be different in the different nerve-cells, still in one and the same cell, and in so far as it depends upon the afferent excitations, it would remain the same its whole life long.

It will be altogether different, however, if these excitations vary qualitatively, according to the nature of the neighboring neurons from which they come, or if the afferent excitation from one and the same neuron may vary within certain qualitative limits. Then a more or less rich multiplicity of excitations will take the place of the just-mentioned monotony that the neuron experiences from its neighbors, and, as this neuron is in its turn capable of heterogeneous activities, there is also opened to it the possibility of reacting to different impulses in different ways.

The nature of this reaction will, of course, also be determined

by the inborn individuality of the neuron; but of the entire stock of innate qualities which it brings with it from birth those will be most fully developed in the course of its life to whose development the neuron is most frequently or most strongly excited by its neighbors. Or, briefly stated, the neuron will possess the capability of qualitative and not merely of quantitative development, which last would, according to the homogeneity theory, alone be possible to it.

According to its place in the nervous system, its more or less manifold relations to other neurons and its inborn structure, this subsequent development will be more or less many-sided, and the doctrine of the homogeneity-theory that the sameness of excitation which the neurons experience conditions a corresponding uniformity in their further development, may perhaps approximately hold for entire large groups of neurons. On the other hand, however, all experience or training both sensory and motor,—in brief, everything that can be called conscious or unconscious memory in the widest sense of the word,—is to my mind not conceivable unless the living substance of the nerve-cells and fibers is capable of a qualitatively variable development.

I have sought in vain in the writings of those supporters of the homogeneity theory who have occupied themselves with considerations concerning the physiological foundations of nutrition and exercise, for a satisfactory conception of the subject. For an explanation of the development of the central nervous system corresponding to the psychical development, we are with reason directed to the possibility of the origin of new connections between the neurons, to alterations of excitability and conductivity in the paths already provided, to the opening and the increasing erosion of certain old paths by use, etc. On all these, old or new, pervious or impervious paths, however, that which is conducted through the nerve-fibers still remains (according to the homogeneity-theory) always the same, and everywhere it is a matter only of moreness or lessness and of variable velocity. The whole nervous system, according to this theory, appears like a land whose numerous communities are connected by a richly developed network of roads, on which latter,

however, always and everywhere, only one and the same kind of wares is transported.

Writers love to compare the nerve-fibers with telegraph or telephone wires, and they will consequently, perhaps, point to the endless multiplicity of things which can be transmitted through wires of exactly the same kind. The comparison is seductive, for if spun out farther, it seems suited to solve all difficulties at a single stroke.

In place of the undoubtedly "obscure" specific or individual "qualities" of the nervous processes of which I have spoken, appears a multiplicity of oscillations of different temporal and spatial form, of which the nerve-substance is the mere *vehicle*. But one finally comes to exactly the same result with this comparison as I do. For one must admit that neither in all nerve-fibers is the same oscillation-form always transmitted, nor is every individual nerve-fiber susceptible of all the oscillation-forms which are possible to the nerve-substance generally, but only of those to which it can respond.

What we have named the specific energy of the fibers or cells reappears here as special resonance-capacities corresponding to definite oscillation-forms. What we formerly called an inborn, acquired or individual characteristic, becomes here the pitch; and, as with us, the specific excitabilities, so here the resonance and previous attunement of the neurons determine the paths in the nervous system which a given oscillation-form shall enter upon.

We accordingly acquire only another mode of expression for one and the same thing; and, as I conceive, one not corresponding so well to the facts, inasmuch as it takes no account of that which in an entirely unique way characterises all life, namely metabolism, that chemical change in the living substance whose qualitative differences it is at present (and may be forever) impossible to express by purely quantitative spatial and temporal terms.

From all that has been said it immediately follows that I not only agree with the teaching of Johannes Müller, but would like to see the scope of his conception much broadened. The specific energies are, according to my view, a phylogenetically acquired

heirloom, not merely of the sensory nerves, but more or less of *all* neurons, of their fibers as well as of their cells. But I consider that the inheritance allotted to the individual neuron is by no means so sparing and uniform as was assumed in the case of the cells of the sensory centers, and further that it was not bequeathed with a codicil that the heir should not add any newly acquired riches to his inheritance.

E. HERING.

LEIPSIC.

De Morgan's mathematical and scientific attainments in physics have not been well catalogued, though they were few in extent due to his having to support his wife and children with a high-class mathematical physicist who was himself a noted man of science. He was then little more than a poor mathematician, however, of high natural gifts, and made progress with difficulty, — hence deriving the benefit of his wife's help in his studies.

DE MORGAN TO SYLVESTER.

THE most extraordinary personage for half a century in the mathematical world was James Joseph, self-styled Sylvester.

The wittiest, most permanently charming of English logicians is De Morgan, founder of the now-towering Logic of Relatives.

No word of Sylvester's about De Morgan has ever been recorded; nor any word of De Morgan's about Sylvester except the brief sentence in a letter to Dean Peacock, November 13, 1838: "You are, of course, interested in all that concerns Dr. Young. A publisher in London has bought or will buy the plates of the *Lectures*. He proposes to republish them (catalogue excepted) in parts, transferring the copper to lithograph. My colleague Sylvester is to put notes, which *with reading* he will do very well."

Once the name occurs in the opening sentence of a letter to Herschel, May 30, 1862:

"My dear Sir John,—I should not wonder if Sylvester and you were at one without any intercommunication of your particles."

That is all.

Yet Sylvester was for a short time a pupil of De Morgan (1828).

There was only eight years difference in their ages, though De Morgan was dead and gone before Sylvester even began his creation of our Western Continent for mathematics.

The pupil, after a decade, became (1837-1838) the colleague, by appointment to the chair of Natural Philosophy in University College, London.

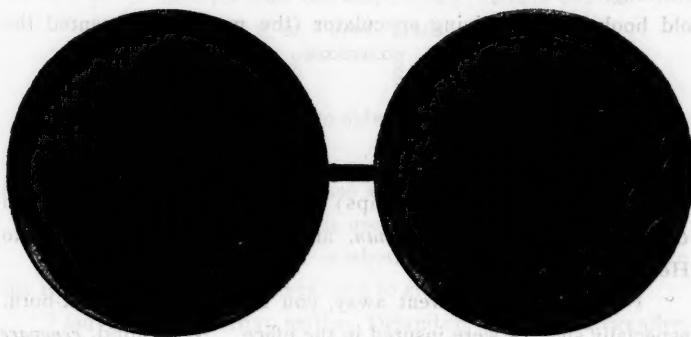
This official connexion was sufficiently brief. Sylvester retired from University College in the session 1840-1841, and immediately

afterwards accepted the Professorship of Mathematics in the University of Virginia.

Of his six months in the wilds of Charlottesville and of his exit thence, least said, soonest mended. The Virginians so utterly failed to understand Sylvester, his character, his aspirations, his superhuman powers, that the Rev. Dr. R. L. Dabney, of Virginia, has seriously assured me that Sylvester was actually deficient in intellect, a sort of semi-idiotic calculating boy!

On the 15th of September, 1855, Sylvester took up the appointment of Professor of Mathematics at the Royal Military Academy, Woolwich, and to him there were written the precious letters from De Morgan which form the final cause of this brief paper.

He occupied K Quarters, Woolwich Common, being the last of a long list of residential professors.



De Morgan's first letter makes it probable that at first, temporarily, he occupied A Quarters on the Common. His permanent residence was a commodious house with a good garden. There, seated under a walnut tree, he made some of the greatest of those marvellous discoveries and creations with which he has enriched all time. Would that the memorial medal, to be awarded triennially by the Royal Society, could have pictured his face lighted with such "solving-the-universe." Instead, the mood it shows is of those periods "wasted in fighting the world."

Not even the existence of the following letters has ever before been known to the world.

7 Camden Street, January 8, 1856.
MY DEAR SYLVESTER.

Can it be *a* the Common? Your mark is A very distinct. Have you given up living at a specific number, and taken to an algebraical symbol?

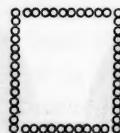
You will certainly be directed to at

a, b, c
 a', b', c'
 a'', b'', c''

if you go on in this way.

I am very glad you like your new quarters. Your simile of Egyptian bondage reminds me that Lincoln's Inn Fields is said to be exactly the size of the base of the great pyramid.

Now some have said that your ancestors built the pyramids in the days when they were making bricks without straw. See the old book which a living speculator (the man who invented the



machine for the postage stamps) says was originally written in Greek, the language of Canaan, and afterwards translated into Hebrew.

I hope, when you went away, you killed all their first-born, especially such as were insured in the office. Nevermind, *renovare dolorem* is one of the pleasures of life—and you are now professionally occupied when you handle a determinant.

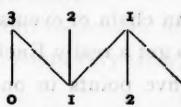
You will smile when you look at the answer to the puzzle.

Who has laid down what they used to call the *affections* of *oblique* spherical triangles, meaning the relations of acute and obtuse? I cannot find anybody. Now the law of these things is as follows;

In every oblique angled spherical triangle, either each side is of the same name (acute or obtuse) with its opposite angle, or an odd number of acute sides coexists with an odd number of obtuse angles.

And conversely, every case contained under the preceding exists, except that *three acute sides cannot exist with three obtuse angles.*

All this is figured in the diagram I sent you, where the upper



numerals denote the number of sides which are acute, and the lower ones the number of ANGLES which are obtuse.

3

Thus

denotes that three acute sides coexist with none

or one obtuse angle.

3

2

1

denotes that one angle (only) obtuse consists with either 3, 2, or 1 acute sides.

2

1

1

1

But

1

1

1

denotes that with two sides acute (and one obtuse) there

must be one, and only one, obtuse angle.

For so small a matter this is useful enough.

What I want to find out is whether anybody has ever taken the trouble to collect the cases, and to state the result.

I am pretty sure that neither Delambre, Puissant, Legendre, Cagnoli, nor T. S. Davies, has done it. And these are the mathematicians I know who have paid most attention to spherical trigonometry in modern times. Yours very truly, A. DE MORGAN.

T. O.

Another actuary has followed you out of that field, but not quite so creditably. Neison is, I understand, hiding from his creditors, and obliged to give up all his posts.

PROBLEM. If a professor at Woolwich runs away from his wife, and his successor takes his house, required to ascertain how far the same successor is bound to take the wife too?

[The Differential Calculus is excluded.]

7 Camden Street, Feb. 10, 1856.

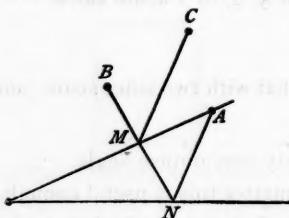
DEAR SYLVESTER:

I send you my exposition of Newton's method, arising out of the Newton-Taylor-Sterling-Stewart-Cramer-Lagrange-Lacroix-Minding-Serret-De Morgan chain of events.

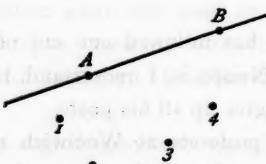
I had been trying to get a really Euclidean demonstration of the proposition that any five points in one plane may be the projection of five points in a circle. All the demonstrations draw a great deal too much upon things visible in algebra but not in geometry.

At every outlet I found a bothering bit of geometry which *just* cut me off. Here was one which I gave to Rutherford, who looked at it, at first with great confidence, as a thing which would be soon finished. But he found himself stopped.

Can you manage it simply?



Given two lines, a point *A* in one of them, and *any* two other points *B*, *C*. Required to draw *BMN* cutting the two lines in *M* and *N* so that *CM*, *AN* are parallel. The problem is certainly Euclidean, for it leads to an equation of the second degree with one unknown quantity. I will not allow you to assume that four points



1, 2, 3, 4, not in a straight line, cannot have more than *two equianharmonic pencils* with their vertices in one straight line. This

is another way out of the original question, and therefore is, I doubt not, connected with the problem I give.

Whence came the word *anharmonic*? It is Chasles's, I believe. Is *an* the *dvā* or the *dv* privative?

I am used to the word *enharmonic* in music, which I suspect is just as badly derived. Yours very truly,

A. DE MORGAN.

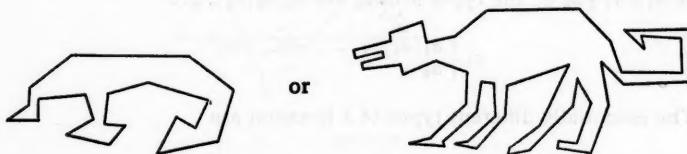
7 Camden Street, April 11, 1856.

DEAR SYLVESTER:

At last I return you your quarter squares, with whole thanks. They go by this post. Newman tells me to-day he hears the journal is abandoned—is it true?

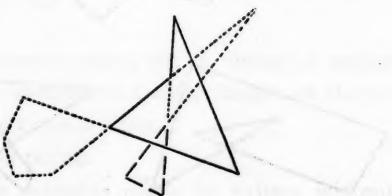
The following connexion between the partition of numbers and the formation of autotomic polygons struck me a few days ago. I find it tames that interminable list of hexagons which one has to draw in Pascal's theorem. (N. B. It is a great pity he had two A's in his name. If he had been Pescal, the hexagon PESCAL would have been a *fait établi*.)

1. Learn to denote a simple polygon—not autotomic—as



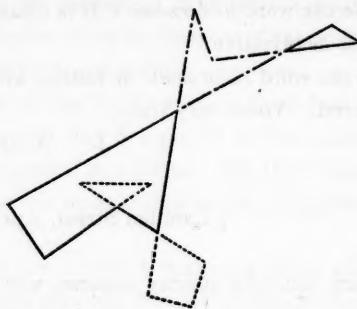
by the number of pairs of right angles in the sum of its internal angles, $m-2$ for an m -gon. Let $m-2$ be the type.

2. Every autotomic polygon is formed by simple polygons joined at opposite angles, as



And the type of the whole is the sum of the types of its parts.

The type of this figure



is $3 \left\{ \begin{matrix} 2 \{ 1 \\ 1 \\ 2 \end{matrix} \right.$ a simple pentagon with two tetragons and a triangle at three angles, and a triangle joined to one of the tetragons.

Or the type may be $2 \left\{ \begin{matrix} 3 \{ 1 \\ 2 \\ 1 \end{matrix} \right.$, $1 \{ 3 \{ \begin{matrix} 2 \{ 1 \\ 2 \end{matrix} \right.$, $2 \{ 3 \{ \begin{matrix} 2 \{ 1 \\ 1 \end{matrix} \right.$, or $1 \{ 2 \{ 3 \{ \begin{matrix} 1 \end{matrix} \right.$

The figure is a $\{(3+2+1+2+1)+2\}$ -gon.

All the partitions of $m-2$ are 2^{m-3} in number. If one of these be $a_1+a_2+a_3+\dots$, the types arising are $a_1\{a_2\{a_3\{\dots$

$a_1 \left\{ \begin{matrix} a_2 \{ a_3 \{ a_4 \{ \dots \end{matrix} \right.$ etc., etc.

The essentially different types of a hexagon are

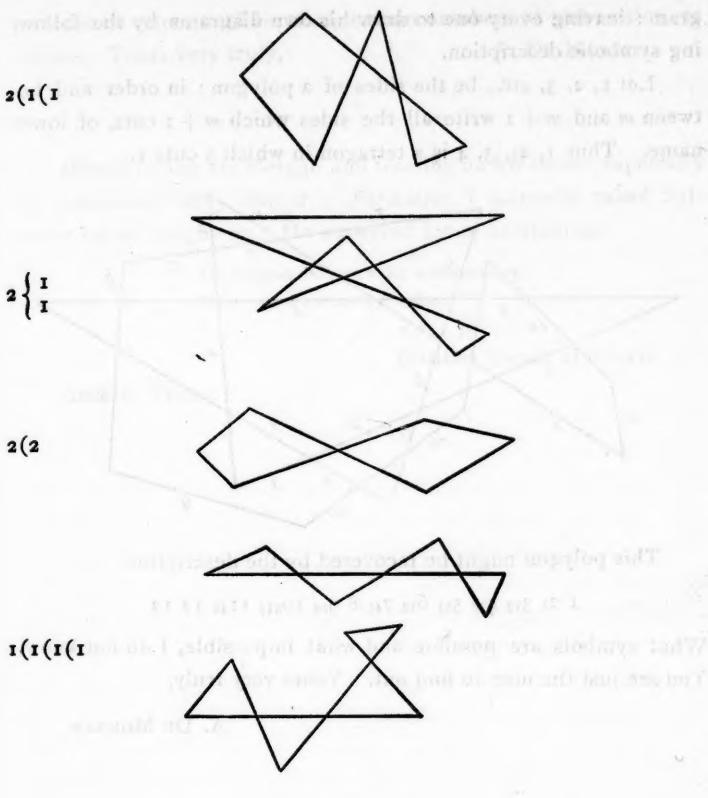
4, $3 \{ 1$, $2 \{ 1 \{ 1$, $2 \left\{ \begin{matrix} 1 \\ 1 \end{matrix} \right.$, $1 \{ 1 \{ 1 \{ 1$, $1 \left\{ \begin{matrix} 1 \\ 1 \end{matrix} \right.$, $2 \{ 2$.

4



$3(1$





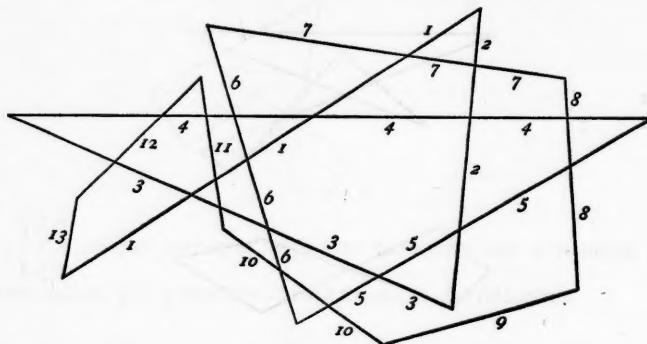
There are many sub-species arising out of choice of angles to join at, angles salient or re-entrant, and sides longer or shorter, so as to affect the mutual sections of sides.

But this is the first rating.

A paper on these polygons might be written without a dia-

gram: leaving every one to draw his own diagrams by the following symbolic description.

Let $1, 2, 3, \dots$, be the sides of a polygon; in order and between m and $m+1$ write all the sides which $m+1$ cuts, of lower name. Thus $1, 2, 3, 4$ is a tetragon in which 3 cuts 1 .



This polygon might be recovered by the description

1 2 1 3 12 4 2 5 12 6 12 7 4 8 9 5 6 10 8 14 11 4 8 12 13.

What symbols are possible and what impossible, I do not know. You are just the man to find out. Yours very truly,

A. DE MORGAN.

91 Adelaide Road, May 14, 1865.

DEAR SYLVESTER:

I am glad to hear that you think the theorem *n*-true. How Newton got it, I never can venture to imagine. He was a very *plodding* man: quite capable of constructing an equation to the 20th degree by given roots, and trying the theorem upon it.

Newton used to try numerical values upon series, by way of verification, and said he should be ashamed to say how far he had gone in this way, and how much time he had spent.

Airy told me—when I was an undergraduate—that no demonstration ever persuaded him that $x - \frac{x^3}{2 \cdot 3} + \frac{x^5}{2 \cdot 3 \cdot 4 \cdot 5} - \dots$ was

periodic in value, until he tried it upon numbers of some value, as
 $x = 10$. Yours very truly,

A. DE MORGAN.

* * *

Myself loving De Morgan and feasting on his books, especially his deliciously witty *Budget of Paradoxes*, I naturally asked Sylvester for his judgment. He answered me in an epigram:

"De Morgan did not write mathematics;
He wrote *about* mathematics!"

GEORGE BRUCE HALSTED.

AUSTIN, TEXAS.

ON PSYCHOLOGY AND METAPHYSICS.¹

BEING THE PHILOSOPHICAL FRAGMENTS OF BERNHARD RIEMANN.

Nec mea dona tibi studio disperta fidi
Intellecta prius quam sint, contemta relinquas.
Lucretius.

WITH every simple act of thinking, something permanent, substantial, enters our soul. This substantial somewhat appears to us as a unit but (in so far as it is the expression of something extended in space and time) it seems to contain an inner manifoldness; I therefore name it "mind-mass." All thinking is, accordingly, formation of new mind-masses.

Mind-masses entering the soul appear to us as ideas, the quality of the latter depending on the inner state of the former.

¹ Translated by C. J. Keyser from Bernhard Riemann's *Gesammelte Mathematische Werke*.

Editors' Note.—The profound purely scientific significance of Riemann's work in pure mathematics and mathematical physics has been long since recognised, and time is more and more disclosing the great philosophical import of portions of that same work, as, for example, of the famous *Habilitationsschrift* on "The Hypotheses that Form the Foundations of Geometry." Riemann was indeed distinctly a *philosophical* mathematician. *Grundlage* (the foundations of things), more than anything else, fascinated his marvellous genius, and his greatest work was exploration among the *roots* of knowledge.

These "Fragments" contain all that Riemann has left us of his direct speculation in psychology and metaphysics. They are a rough and incomplete record of his thought, but for boldness and vigor they resemble very much some of his scientific productions. Some of his profoundest ideas have certainly not been duly exploited. In their German dress, they are to many people practically inaccessible, and to bring them more fully before the thinking public has been our purpose in presenting them to the English reader.

The psychological ideas which Riemann has here set forth bear clearly the im-

Forming mind-masses amalgamate, combine or compound themselves in definite degree, partly with each other, partly with older mind-masses. The manner and strength of these combinations depend on conditions which are but imperfectly recognised by Herbart and which I shall complete in the following. They depend chiefly upon the inner relationship of the mind-masses.

The soul is a compact of mind-masses combined in a most intimate and manifold manner. It grows constantly by accession of mind-masses, and upon these depend its development.

Mind-masses, once formed, are imperishable, their combinations are indissoluble; only the relative strength of these combinations is altered by the incoming of new mind-masses.

Mind-masses require for their continued existence no material support and produce upon the physical world no abiding effect. They stand, therefore, in no relation to any part of matter and have, accordingly, no position in space.

On the other hand every entrance, every nascence, every formation, of new mind-masses and all combinations of them require a material agent or support. All thinking occurs therefore in a definite place.

(Not the retention of our experience, it is only the thinking that strains; and the force expended, so far as we can estimate this, is proportional to the mental activity).

Every entering mind-mass excites all related mind-masses and this excitation is the more powerful the more insignificant the diversity of their inner states (quality).

This excitation is not restricted merely to the related mind-masses but extends itself mediately also to those cohering with them

press of the thought of his place and period, which was predominantly Herbartian, and of his own special mathematical and mechanical proclivities. Some readers may find the study of these pages difficult and perhaps even unprofitable. For like Riemann's purely philosophical ideas, which were influenced by Fechner, his psychology will, at least in its terminology, be found to be at variance in many points with the views and tendencies of the time. They have, however, a quite independent significance as throwing light upon Riemann's own intellectual development, and thus, apart from whatever intrinsic merit they may possess, form a valuable page in the history of the development of thought.

(i. e., to those combined with them in earlier processes of thought). If, therefore, part of the related mind-masses hang together among themselves, then these are not only immediately excited but also mediately and consequently in proportion more powerfully than the rest.

The reciprocal action of two simultaneously forming mind-masses is conditioned by a material process (*Vorgang*) between the places where the two are forming. Likewise from material causes all forming mind-masses enter into immediate reciprocal action with those formed just before; but all older mind-masses cohering with the latter are excited mediately to action and in measure so much the less the looser this coherence and the weaker the bond of union among themselves.

The simplest and most common manifestation of the activity of older mind-masses is Reproduction, which consists in the striving of the active mind-mass to engender one similar to itself. The formation of new mind-masses is based upon the common action partly of older mind-masses, partly of material causes, and these common agents are hindered or helped by the inner dissimilarity or similarity of the mind-masses they strive to generate.

* * *

The form of the forming mind-mass (or the quality of the idea accompanying its formation) depends on the relative motion-form of the matter in which it is constructed, so that similar motion-forms of the matter condition similar forms of the mind-masses formed in it; and, conversely, like forms of mind-mass presuppose like forms of motion of the matter in which they have been formed.

All mind-masses simultaneously forming (in our cerebrospinal system) combine in consequence of a physical (chemico-electric) process between the places where they are forming.

Every mind-mass strives to produce a like-formed mind-mass and, accordingly, strives to produce that form of motion of the matter by which it was formed.

* * *

The assumption of a soul as a unitary support of the permanent somewhat (the ideas) which is produced by the separate acts of the

soul-life is based (1) on the intimate coherence and the reciprocal interpenetration of all ideas. In order, however, to explain the combination of a definite new idea with others, the assumption of a unitary support is not alone sufficient; much more, the cause on account of which the idea enters into just these definite combinations, in this definite strength, must be sought in the idea with which it combines. But the assumption of a unitary support of all ideas in addition to these causes is superfluous.

We now apply these laws of mental processes, to which the explanation of our own inner consciousness leads, to explain the order and adaptation observed on the earth, i. e., to explain Being and historical development.

In order to explain our soul-life we had to assume that the mind-masses generated in our nerve-processes continue as parts of our soul, that their inner coherence persists unchanged and that they are subject to variation only in so far as they enter into combination with other mind-masses.

An immediate consequence of these principles of explanation is that the souls of organic beings, i. e., the compacts of mind-masses, arisen during life, continue to exist after death. (Their isolated persistence is not sufficient). But in order to explain the orderly development of organic nature in which the earlier collected experiences obviously serve as basis for the later creations, it is necessary to assume that these mind-masses enter into a greater compact of mind-masses, the Earth-Soul, and that these serve a higher soul-life according to the same laws as the mind-masses engendered in our nerve-processes observe in their service of our own soul-life.

As, for example, at the sight of a red surface the mind-masses, begotten in a multitude of distinct primitive fibers, combine into one single compact mind-mass, which appears at the same instant in our thought, so the mind-masses engendered in the different individuals in a plant-genus which from a climatically little diversified region of the earth enters into the earth-soul, combine into a single whole expression (*Gesammeindruck*). As the different sense-perceptions of the same object unite in our soul into one single

picture of the object, so will all plants of a given region of the earth give to the earth-soul a most minutely elaborated picture of the climatic and chemical conditions of such region. In this way it is made plain how from the earliest life of the earth the order and plan of later creations developed.

According to our principles of explanation the persistence of existing mind-masses requires no material support, but all combinations of them, at least all combinations of different varieties of mind-masses, can take place only by means of new mind-masses engendered in a common nerve-process.

For reasons that will be unfolded later, the substratum of mental activity must be sought only in ponderable matter.

Now it is indeed impossible to refer the rigid earth-crust and all ponderable masses above it to a common mental process, but the motions of these masses must be explained from other causes.

Accordingly there remains only the assumption that the ponderable masses within the rigid earth-crust are supporters of the soul-life of the earth.

Are they adapted to this end? What are the external conditions for the possibility of life? The common experiences relating to such life-processes as are accessible to observation must form the basis in this investigation; but only within the limit of our ability to explain them are we able to draw thence conclusions likewise applicable to other regions of phenomena.

The general experiences concerning the outer conditions of the process of life within the circuit of phenomena accessible to us, are:

1. The more highly and completely developed the life-process, the more the supporters of the latter require protection against outer disturbances tending to alter the relative position of the parts.
2. The known physical processes (*Stoffwechsel*) that serve as means to the thought-processes, are:
 - a. The absorption of elastic fluids by liquids.
 - b. Endosmosis.
 - c. The formation and resolution of chemical combinations.
 - d. Galvanic currents.

3. Organic matter has no discernible crystalline structure; it is partly solid (slightly brittle), partly gelatinous, partly liquids or elastic fluids but always porous, i. e., notably penetrable by elastic fluids.

4. Among the chemical elements only the four so-called organic elements are general supporters of the life-process, and of these, again, entirely definite combinations, the so-called organising combinations, are compound parts of the organic body (protein, cellulose, etc.).

5. Organic combinations persist only up to a definite upper limit of temperature, and only down to a certain lower limit can they be supporters of the life-process.

Changes in the relative position of the parts are effected in greater degree by mechanical forces, in less degree by variations of temperature, in still less degree by rays of light; accordingly, we may arrange the facts which together constitute our theorem, as follows :

1. The ability of the lower organisms to propagate by division. The gradually decreasing reproductive power in case of the higher animal organisms.

2. The parts of plants are the more sensitive to change of temperature, the intenser and the more highly developed the life-process in them. In the higher animal organisms, particularly in the most important parts, there prevails an almost constant temperature.

3. The parts of the nervous system that serve as seats for independent activity of thought, are protected as much as possible against all these influences.

The fact first stated is obviously grounded in this, viz., the relative position of the parts can be the more readily determined by processes within the matter, the less it can be determined by external circumstances. This freedom from external circumstances is found however within the earth's crust in far higher degree than has been attained by organic contrivances outside the crust.

Among the following facts, which we consider collectively, those grouped under (4) and (5) appear to contradict our assump-

tion; they would do so in fact, if an absolute validity were assignable to the conditions we perceive for the possibility of a life-process and not merely a relative validity for our own circle of experience. Against the ascription to them of absolute validity there lie, however, the following objections:

1. In that case the whole of nature, with the single exception of the earth's surface, would have to be regarded as dead, for on all other heavenly bodies there prevail conditions of heat and temperature under which organic combinations could not exist.

2. It is absurd to assume that upon the rigid earth-crust the organic originated from the inorganic. In order to explain the nascence of the lowest organisms on the earth-crust, one must assume an already existing organising principle or a thought-process, under conditions that would render organic combinations impossible. We must accordingly assume that these conditions are valid only for the life-process in the actual state of the earth's surface, and only so far as we can explain them may we estimate the possibility of life-processes under other conditions.

Why then are only the four organic elements general supporters of the life-process? The reason can be sought only in properties by which these four elements are distinguished from the rest.

1. Such a common property of these four elements is found herein, that of all stuffs they and their combinations are condensed with greatest difficulty and in fact up to the present time, even not at all.

2. Another common property of these elements is the great multiplicity of their combinations and their easy resolubility. This property might be as well the consequence as the cause of their appropriation to the life-processes.

That, however, the former property, difficulty of condensation, makes the four elements peculiarly fit to serve life-processes, is already partly explained immediately from the actual conditions of the life-process, that are grouped under (2) and (3), but yet more if we seek to assign to their causes the phenomena of condensation of gases to liquids and solids.

Zend-Avesta, a truly life-giving word¹ creating new life in knowledge as in faith! For how many a thought, which, once mighty indeed in the development of man, preserved in us through tradition only, all at once now rises again out of its seeming death, in purer form to new life, disclosing new life in nature! For how immeasurably unfolds before our eyes the life of nature, which hitherto manifested itself only on the surface of the earth, how unspeakably sublimer does it now appear than formerly! What was considered as the seat of mindless unconscious forces appears now as the workshop of the highest spiritual activity. In wondrous fashion is fulfilled what our great poet in prophetic trance depicted as the goal that hovered before the mind of the investigator.

As Fechner in his *Nanna* sought to show that plants have souls, so the point of departure of his contemplations in the *Zend-Avesta* is the doctrine that the stars have souls. The method he employs is not that of the abstraction of general laws by induction and the application and testing of these in the explanation of nature, it is analogy. He compares the earth with our own organism, which we know to be endowed with a soul. He searches out not merely in a one-sided way the similarities, but does equal justice to the dissimilarities, too, and so arrives at the conclusion that all the former show the earth to be a being with a soul, and that all the latter indicate that it is a being with a soul far higher than our own.

The convincing power of this representation lies in its all-sided elaboration in detail. The total impression of the picture unfolded before us of the life of the earth must tend to justify the view and supply what the single conclusions lack in rigor. This evidence rests essentially upon the intuitive apprehensibility of the picture, upon its exceeding susceptibility of being executed in detail. I should accordingly deem it unjust to Fechner's view, should I endeavor to give by extracts an account of his procedure. In the following discussion of Fechner's views I will abstract from the form in which they are presented and fix attention on their substance only, and will rely on the former method, that of the abstraction

¹ Cf. Fechner, *Zend-Avesta*, I, Preface.

of general laws by induction and their verification in the explanation of nature.

Let us ask first: Whence do we conclude that a thing has a soul (the occurrence in it of a persistent unitary thought-process)? Of our own possession of a soul we are immediately certain; in case of others (men and animals) we infer such possession from individual purpose-serving movements.

Wherever we trace well ordered adaptation of means to ends back to a cause, we seek this cause in a thought-process; we have no other explanation. But thinking itself I at least can regard as only a process in the interior of ponderable matter. The impossibility of explaining thinking as motion of matter in space is clear to every one after an unbiased analysis of the inner consciousness; yet the abstract possibility of such an explanation may be here conceded.

That adaptation of means to ends is observed upon the earth, no one will deny. Accordingly the question arises, where ought we to locate the thought-process which is the cause of this adaptation? We are here concerned only with conditioned ends (i. e., such as are restricted to limited times and spaces); unconditioned ends find their explanation in an eternal will (not engendered in a thought process). The only adaptation of means to ends, whose cause we perceive, is the adaptation of our own actions. It rises out of the willing of the end and reflection upon the means.

If now we find a body consisting of ponderable matter with a completely closed system of permanent end-and-means-combinations, then we may assume for the explanation of this adaptation an enduring thought-process in the same; and this hypothesis will be most probable if (1) the adaptations are not in parts of the body already closed, and (2) if no reason exists for seeking the cause of the adaptation in a greater whole to which the body belongs.

If we apply this to the adaptation observed in men, animals and plants, it results that one part of this adaptation is explained from a thought-process in the interior of these bodies, that another part, however, the adaptation of the organism, by a thought-process in a greater whole.

The grounds hereof are:

1. The adaptation of organic arrangements is not closed in the single organisms. The reasons for the arrangement of the human organism are obviously to be sought in the character of the whole surface of the earth, which includes organic nature.

2. Organic movements repeat themselves innumerably, partly in different contemporaneous individuals, partly in the life of one individual or of a family succession.

3. The organic arrangements receive on the one hand (i. e., in case of man and animals) in the life of the single individuals, and on the other (i. e., in case of plants and embryos) in the life of the single species, no continuous development. The cause of their adaptation is accordingly not to be sought in a simultaneously progressing thought-process.

After abstracting from these (organic) adaptations, there remains now in case of man and animals as is well known, and, according to Fechner's view, in case of plants, still a closed system of variable end-and-means interlocking relations (*in einander greifender veränderlicher Zweck- und Wirkungsbezüge*); and this adaptation is to be explained from a unitary thought-process in them. These consequences of our principles are confirmed by our inner consciousness. According to the same principles we must seek the cause of the adaptations observed in organisms in a unitary thought-process in the earth on the following grounds:

a. The end-and-means-relationship in the organic life of the earth does not break up into separate systems but is all comprehended in one. Accordingly it cannot be explained from several separate and distinct thought-processes in parts of the earth.

b. There is within the limits of our experience no reason to seek the causes of these adaptations in a greater whole. All organisms are designed only for life upon the earth. The state of the earth's crust accordingly contains all (external) reasons of its arrangement.

c. They are peculiar (individual). According to all that experience teaches we must assume that they are not repeated on other heavenly bodies.

d. Neither do they last during the life of the earth but rather in the course of this life there constantly appear new and more complete organisms. We must accordingly seek the cause in a thought-process simultaneously progressing to higher order.

From the standpoint of exact natural science, of the explanation of nature from causes, the assumption of an earth-soul is accordingly an hypothesis for the explanation of Being and of the historical development of the organic world.

"When the body of the lower soul dies," says Fechner, "the higher soul takes it up out of its life of contemplation into its life of reminiscence." The souls of perished creatures shall, therefore, form the elements of the soul-life of the earth.

The different thought-processes seem to differ chiefly in respect to their temporal rhythm. If plants have souls, then hours and days must be for them what seconds are for us. The corresponding period for the earth-soul, at least for its outward activity, possibly embraces many thousands of years. So far as the historical recollection of man extends, all movements of the earth-crust are to be explained from mechanical laws.

ANTINOMIES.

Thesis.

Finite, Representable.

Antithesis.

Infinite, System of Notions lying at the limit of the representable.

I.

Finite elements of Space and Time.

Continuity.

II.

Freedom, i. e., not the power absolutely to originate, but to pass judgment between two or more given possibilities.

Determinism.

In order that decision by arbitrary power may be possible in spite of completely definite laws of the action of ideas, one must assume that the psychic mechanism itself has, or at least in its development acquires, the peculiar property of inducing the necessity of these laws.

No one can, in case of affairs, abandon the conviction that the future is co-determined by his transactions.

III.

A God working in Time. (Govern-
ment of the world).

A timeless, personal, omniscient, al-
mighty, all-benevolent God (Providence).

IV.

Immortality.

A thing in and by itself endowed with
transcendental freedom, radical evil, in-
telligible character and lying at the basis
of our temporal appearance.

Freedom is very well compatible with
sound lawfulness of the course of nature.
But the concept of a timeless God is
then untenable. But the restriction
which omnipotence and omniscience suf-
fer through freedom of the creature in
the sense above determined, must be
eliminated by the assumption of a tem-
porally acting God, of a ruler of the
hearts and destinies of men ; the concept
of Providence must be supplemented and
in part replaced by the notion of govern-
ment of the world.

**GENERAL RELATION OF THE CONCEPT SYSTEM OF THESIS AND
ANTITHESIS.**

The method applied by Newton to the grounding of the Infinitesimal Calculus, and which since the beginning of this century has been recognised by the best mathematicians as the only one that furnishes sure results, is the method of limits. The method consists in this, viz., instead of considering a continuous transition from one value of a quantity to another, from one position to another, or, speaking generally, from one determination of a concept to another, one considers in the first place a transition through a finite number of intervals and then allows the number of these intervals to increase so that the distances of two successive points of division all decrease infinitely.

The concept-systems of antithesis are concepts that are indeed thoroughly determined by negative predicates but are not positively representable.

Just because a precise and complete representation of these concept-systems is impossible, they are inaccessible to direct investigation and elaboration by our reflection. They may, however, be regarded as lying at the limit of the representable, i. e., we can form a concept-system lying within the representable, which passes over into the given system by simple change of magnitude ratio. By abstracting from the ratios of the quantities, the concept-system remains unchanged in case of transition to the limit. At the limit itself, however, some of the correlative concepts of the system lose their susceptibility of being represented, and those, indeed, that mediate the relation between other concepts.

**THEORY OF KNOWLEDGE; OR, AN ATTEMPT AT A DOCTRINE OF
THE GROUND-NOTIONS OF MATHEMATICS AND PHYSICS AS
FOUNDATION FOR THE EXPLANATION OF NATURE.**

Natural science is the attempt to comprehend nature by precise concepts.

According to the concepts by which we comprehend nature not only are observations completed at every instant but also future observations are pre-determined as necessary, or, in so far as the concept-system is not quite adequate therefor, they are predetermined as probable; these concepts determine what is "possible" (accordingly also what is "necessary," or the opposite of which is impossible), and the degree of the possibility ("the probability") of every separate event that is possible according to them, can be mathematically determined, if the event is sufficiently precise.

If what is necessary or probable according to these concepts occurs, then the latter are thereby confirmed and upon this confirmation by experience rests our confidence in them. If, however, something happens which according to them is not expected and which is therefore according to them impossible or improbable, then arises the problem so to complete them, or if necessary, to transform them, that according to the completed or ameliorated concept-system, what is observed ceases to be impossible or improbable. The completion or amelioration of the concept-system forms the "explanation" of the unexpected observation. By this process our

comprehension of nature becomes gradually always more complete and assured, but at the same time recedes even farther behind the surface of phenomena.

The history of the illuminating natural sciences, as far as we are able to trace it back, shows that this is in fact the way in which our knowledge of nature advances. The concept-systems on which these sciences are now based arose by gradual transformation of older concept-systems, and the reasons which incited to new modes of explanation may be always traced back to contradictions or improbabilities that emerged in the older modes of explanation.

The formation of new concepts, so far as it is accessible to observation, occurs therefore by that process.

Now it has been proved by Herbart that also those concepts serving to comprehend the world, whose origin we are unable to trace either in history or in our own development because of their imperceptible transmission to us along with speech, may all be derived from this source, in so far as they are more than mere forms of combinations of simple sensuous ideas, and that accordingly they need not be derived (as according to the Kantian categories) from a peculiar constitution of the inner soul, anterior to all experience.

This proof of their origin in the comprehension of what is given by sense-perception is therefore important for us because *only thereby their significance can be established in a manner adequate for natural science.*

After the notion of things existing for themselves (*für sich bestehender Dinge*) has been formed, reflexion upon change, which contradicts the notion of existence for self, gives rise to the problem to maintain as far as possible this already proved notion. Out of this rises at the same time the notions of continuous change and of causality.

Only transition of a thing out of one state into another, without a leap being perceived, is observed. By way of supplementation, we may assume either that the transition occurs by a very great but finite number of imperceptible leaps or that the thing

passes over from the one state into the other through all intervals. The strongest reason for the latter conception lies in the necessity of maintaining as much as possible the already established notion of things existing for themselves. It is indeed impossible actually to imagine a transition through all intervals, a fact however, as already observed, that, taken narrowly, holds of all concepts.

According to the earlier formed and experientially proved notions of the existence of things, for themselves, it is concluded that a thing would remain what it is, were nothing else added. Herein lies the incitement to seek a cause for every change.

1. When is our conception of the world correct?

"When the coherence of our ideas corresponds to the coherence of things."

The elements of our picture of the world are entirely different from the corresponding elements of the depicted real. The former are something within us; the latter something without. But the combinations of the elements in the picture must coincide with those of the elements in the depicted, if the picture is to be true. The truthfulness of the picture is independent of its niceness; neither does it depend on the question, whether the elements of the picture represent greater or smaller masses of the elements of the real. But the combinations must correspond to each other; an immediate effect of two elements upon each other must not be assumed in the picture, where in reality only mediate effect occurs. In this case the picture were false and in need of correction; if, on the other hand, an element of the picture is replaced by a group of finer elements, so that its properties result partly from simpler properties of the finer elements, partly also from their combinations, and become accordingly in part intelligible, then thereby is indeed increased our insight into the coherence of things, without, however, the earlier conception being declared false.

2. From what shall the coherence of things be found?

"From the coherence of phenomena."

The idea of sense-things in definite space and time relations is what is found by intentional reflection upon nature or what is *given* for such. As is well known, however, the *quality* of the characters

of sense-things, color, sound, tone, smell, taste, heat or cold, is something merely taken from our sensation, something not existing outside of us.

That by which the coherence of things must be known is accordingly quantitative relations, the space and time relation of sense-things and the intensity relations of the characters and their qualitative differences.

Knowledge of the coherence of things must result from reflection upon the observed coherence of these magnitudinal relations.

CAUSALITY.

1. What an agent strives to effect must be determined by the concept or idea of the agent, its action can depend on nothing else than its own nature (*Wesen*).

2. This requirement is satisfied when the agent strives to preserve or to restore itself.

3. Such an action is, however, not thinkable if the agent is a thing, a being (*Seiendes*), but only if it is a state or relation. If a striving to preserve or to restore something occurs, then also deviations from this something must be possible and indeed in different degrees; and in so far as this striving is opposed by other strivings the preservation or restoration is at most only approximate. But there are no degrees of being, a gradual difference of only states or relations being thinkable. Accordingly, if an agent strives to preserve or to restore itself, then it must be a state or relation.

4. Such an action of a state, it is self-evident, takes place only upon such things as are capable of a like state. Upon which of these things, however, it takes place and whether it takes place at all cannot be inferred from the idea (*Begriff*) of the agent.¹

¹ These propositions are valid only if the action (*Wirken*) is to be ascribed to a simple real cause (*Realgrund*).

If two things *a* and *b* by an external cause enter into combination, then a consequence *c* may be attached either to the combination, the state itself of being combined, or indeed to the change of their ranks. The simplest assumption is that the consequence *c* is attached to the state of being combined.

It is unnecessary to extend these considerations further. Their principle con-

Kant has rightly observed that by the resolution of the concept of a thing we can find neither that it exists nor that it is the cause of something else, and accordingly that the concepts of being and causality are not analytical but can be derived only from *experience*. When however he later feels himself obliged to assume that the notion of causality originates in a pre-experiential property of the cognising subject and therefore stamps it a mere rule of time-series, by which, in experience, with each observation as cause *any other* could be connected as effect, then is the child thrown out with the bath. (Indeed, we must derive the relations of causality from experience; but we must not fail to correct and to complete our conception of these facts of experience by reflection.)

The word hypothesis has now a somewhat different significance from that given it by Newton. We are now accustomed to understand by hypothesis all thoughts connected with the phenomena.

Newton was far from the crude thought that explanation of phenomena could be attained by abstraction.)

Newton: *Et haec de deo; de quo utique ex phaenomenis disserere ad philosophiam experimentalem pertinet. Rationem vero harum Gravitationis proprietatum ex phaenomenis nondum potui deducere, et Hypotheses non fingo. Quicquid enim ex Phaenomenis non deducitur, Hypothesis vocanda est.*

Arago, *Œuvres complètes*, T. 3, 505, says: *Une fois, une seule fois Laplace s'élance dans la région des conjectures. Sa conception ne fut alors rien moins qu'une cosmogonie.*

sists herein that we hold fast the law: "What an agent strives to effect must be determined by the idea of the agent," but that we do not apply this law as did Leibnitz or Spinoza to beings with a manifoldness of determinations but to real causes of the greatest possible simplicity.

We are accustomed in German to translate *actio* as well as *effectus* by effect (*Wirkung*). As the word occurs most frequently in the latter sense, there easily arises an obscurity when we use it for *actio*, as for example, in case of the usual translation of "*actio aequalis est reactioni*," "*principium actionis minima*." Kant sought to avoid the difficulty by adding in parenthesis beside effect, mutual action (*Wirkung, Wechselwirkung*) the Latin expression *actio, actio mutua*. We might venture to say: "Force is equal to the opposite force." "Law of least force expenditure." Since however we have in fact no simple expression for *agere*, an effort directed upon something else, we may be permitted to make use of foreign words.

Laplace to a question by Napoleon, why in his *Mécanique céleste* the name of God did not appear: *Sire, je n'avais pas besoin de cette hypothèse.*

The distinction which Newton makes between laws of motion or axioms and hypotheses seems to me untenable. The law of inertia is the hypothesis: If a material point were alone in the world and moved in space with a definite velocity, it would preserve this velocity constantly.

the author of the *Buddha-caritakâvya*,¹ the famous poem on the life of Buddha. The accounts of his life and of the significance of his philosophy are so few that the important influence exercised by him upon the development of the Mahâyâna Buddhism has been left almost entirely unnoticed. That he was one of the most eminent leaders among earlier Buddhists; that he was in some way or other connected with the third convocation in Kashmir, probably presided over by the Bhikshu Parçva; that he had a wonderful poetical genius which rendered great service in the propagation of Buddhism,—these facts sum up almost all the knowledge possessed by scholars about Açvaghosha. The reason why he is not known as he ought to be, is principally that the Sanskrit sources are extremely meagre, while the accounts obtainable from Chinese and Tibetan traditions are confusing and full of legends.

This fact has led Professor Kern to say that Açvaghosha was not an historical man, but a personification of Kâla, a form of Çiva.² But the sources from which the Professor draws his con-

¹ *The Sacred Books of the East*, Vol. XLIX. Beal's English translation of the Chinese translation "The Fo sho hing tsan king," *S. B. E.*, Vol. XIX.

² *Der Buddhismus und seine Geschichte in Indien*, authorised German translation, Leipsic, 1884, Vol. II., p. 464.

ACVAGHOSHA, THE FIRST ADVOCATE OF THE MAHÂYÂNA BUDDHISM.

clusion are rather too meagre and I fear are not worth serious consideration. In the following pages we shall see by what traditions Açvaghosha's life is known to the Buddhists of the East.

DATE.

Let us first decide the date, which varies according to different authorities from three hundred to six hundred years after the Parinirvâna of Buddha.

1. The *Li tai san pao chi* (*fas. 1*),¹ quoting the Record of the Sarvâstivâdin school, says: "Açvaghosha Bodhisattva was born a Brahman in Eastern India some three hundred years after the Nirvâna. After he abandoned his worldly life, he refuted all the doctrines held by the *tirthakas* (heathen),² and writing the Mahâ-alamkâra-çâstra³ in several hundred verses (*gâthâs*) greatly propagated the teachings of Buddha."

2. Hui-yuen⁴ states in his commentary (*fas. 1*) on the Mahâ-prajñâ-pâramitâ-çâstra,⁵ on the authority of Kumârajîva 楊摩羅什 (A. D. 339-413), that Açvaghosha flourished about three hundred and seventy years after the Nirvâna.

3. In the *Life of Vasubandhu*,⁶ Açvaghosha is mentioned as a contemporary of Kâtyâyana who is said in the same book to have been living in the fifth century after the Nirvâna.

4. The writer⁷ of the preface to the second Chinese translation

¹歷代三寶記 (*Records of the Triratna under Successive Dynasties*), compiled by 費長房 Fe Chang-fang, A. D. 597; 15 fasciculi.

² Tîrthaka, which literally means "ascetics," was first applied to a definite sect, viz., the naked ascetics of the Jains, but was later on extended to all dissenters and has therefore been translated "heretics or heathen." The Chinese translation of the term literally means "[followers of a doctrine] other than Buddhism."

³ Translated into Chinese by Kumârajîva, circa A. D. 405. 15 fasciculi.

⁴ 懿遠 A. D. 333-416. The leader of the *Pai lien she* (White Lotus Society), first Sukhâvatî sect movement in China.

⁵ *Treatise on the Great Wisdom-Perfection*, by Nâgârjuna. A Chinese translation by Kumârajîva, A. D. 402-405. 100 fasciculi.

⁶ The original Sanskrit author is unknown. The present Chinese translation is by Paramârtha who came to China from Western India A. D. 546.

⁷ The writer's name is not mentioned there, nor the date; but judging from the knowledge he shows in treating the subject, as we shall see later, he must have been living either at the time of this second translation or immediately after it.

of the Mahâyâna-çraddhotpâda-çâstra¹ says that this Çâstra "is the deepest of the Mahâyâna texts. Five hundred years after the Nirvâna, Açvaghosha appeared in the world. He was numbered among the four suns [of Buddhists] and his teachings stood most prominently [among the doctrines prevailing] in the five countries of India."

5. Sang-ying² states in his preface to the Chinese translation of the Mahâprajñâpâramitâçâstra that Açvaghosha appeared towards the end of the period of Orthodoxy, i. e., five hundred years after the Nirvâna.

6. The *Fu tsou t'ung chi*³ (Vol. V.) says that it was the fulfilment of the Tathâgata's prophecy that six hundred years after the Nirvâna the Dharma was transmitted to Açvaghosha.

7. This six hundred year prophecy is adopted as if it were an unquestionable fact, by Fa-tsang,⁴ a learned commentator of the Çraddhotpâdaçâstra (*Discourse on the Awakening of Faith*).

8. Chih-k'ai 詩懶 who was the copyist for Paramârtha when he translated the Çraddhotpâdaçâstra, also adheres to the six hundred year tradition in his preface to the book just mentioned, saying that some six hundred years after the Nirvâna of the Tathâgata, many devilish heretical leaders clamorously protested their false doctrines against the good law of Buddha, when a Çrâmanî of very high virtue called Açvaghosha, thoroughly versed in the philosophy of the Mahâyâna Buddhism and highly compassionate for those ignorant people, wrote this Discourse (the Çraddhotpâdaçâstra), in order that he might increase the brilliancy of the Triratna, etc., etc.

9. The six hundred year tradition is very popular among Chinese and Japanese Buddhists. The *Fa tsu li tai tung tsai*⁵ (fas. 5) also follows it.

¹ *Discourse on the Awakening of Faith in the Mahâyâna*, the principal work of Açvaghosha.

² 僧叡. A. D. 362-439. One of the four famous disciples of Kumârajîva.

³ 佛祖統記. A history of Buddhism, compiled by Chih-p'an 志顛, a Chinese priest, during the latter half of the thirteenth century. 34 fasciculi.

⁴ 643-712. A most prominent leader of the Avatamsaka sect in China.

⁵ 佛祖歷代通載. *A History of Buddha and the Patriarchs through Successive Dynasties*, by Nien chang 奈常, A. D. 1333. 36 fasciculi.

10. The prophecy above referred to (see No. 8), which is doubtless a later invention, appears in the *Mahāmāyā sūtra*¹ (*fas-
ciculi* 2) as follows:

"After the death of Buddha, Mahāmāyā asked Ānanda if Buddha had ever told him in his life anything concerning the future of Buddhism. Responding to this, Ānanda said: 'I heard one time Buddha say this with regard to the future decline of Buddhism: "After the Nirvāna Mahākāyapa with Ānanda will compile the Dharma-piṭaka, and when it is settled Mahākāyapa will enter into a Nirodha-samāpatti in the *Lang chi shan* [i. e., Mount of Wolf's Track, Kukkurapadagiri], and I (Ānanda) too obtaining the fruit of enlightenment will in turn enter into Parinirvāna, when the right doctrine will be transmitted to Upagupta who will in an excellent manner teach the essence of the Dharma. . . . When five hundred years are passed [after Buddha's death] a Bhikshu named Pao-tien (Ratnadeva?) will in an excellent manner teach the essence of the Dharma, converting twenty-thousand people and causing all sentient beings in the eight creations to awaken the *Anuttara-samyaksambodhicitta* (most-perfect-knowledge-mind). The right doctrine will then go to decline. When six hundred years [after Buddha's death] are expired, ninety different schools of the *tīrthakas* will arise and proclaiming false doctrines, each will struggle against the other to destroy the law of Buddha. Then a Bhikshu, Aṣvaghosha by name, will in an excellent manner teach the essence of the Dharma and defeat all the followers of the *tīrthakas*. When seven hundred years [after Buddha's death] are expired, a Bhikshu, Nāgārjuna by name, will in an excellent manner teach the essence of the Dharma, destroying the banner of false philosophy and lighting the torch of the right doctrine."

11. Referring to the statement of the above mentioned Sūtra, Nāgārjuna a famous Buddhist philosopher who wrote a commentary on Aṣvaghosha's work, called *Çraddhotpādaçāstra*, claims that

¹ The Sūtra is also called the "Sūtra on Buddha's Ascent to the *Trayaśrima* Heaven, to Teach the Dharma to His Mother." 2 fasciculi. A second Chinese translation by Shih T'an-ching 詩晏景 of the Ch'i dynasty 齋 (A. D. 479-502). His nationality and life both are unknown.

there were six Aṣvaghoshas at different times, to fulfil the prophecy of Buddha and that the author of the book on which he writes a commentary¹ was one who appeared on earth according to the proph-

¹ The Sanscritised title is the *Mahāyānaçāstravyākhyā*, translated into Chinese by Pa-ti-mo-to 答提摩多, an Indian priest, A. D. 401-2. *10 fasciculi*. The statements in full run as follows :

"In all there were six Aṣvaghoshas, owing to different predictions in the sūtras; each of them appeared to fulfil his mission according to the necessity of the time and there is no contradiction in them."

The author then proceeds to make particular references to those sūtras :

"When we examine all different predictions in the sūtras taught by Buddha through his whole life, we find six different [personages all called Aṣvaghosha]. What are those six? (1) According to the *大乘本法契經* *Tai ch'eng p'en fa ch'i ching* (*Mahāyānapūrvadharmaśūtra?*), we have the following : When the peerless, great, enlightened, honored one was speaking about his intention of entering into Nirvāna, Aṣvaghosha rising from the seat knelt down, saluted Buddha's feet, and respectively joining his hands together turned towards Buddha, the world-honored one, and said this in verse : 'The peerless one whose heart is filled with great love and whose immeasurable virtues have been accumulated through aeons which are like a boundless ocean, the Buddha, only on account of love and compassion for all sentient beings, now speaks about his entering into Nirvāna, and I and all the other members of the Samgha feel an unspeakable despair, utterly confused in mind and spirit. If even the world-honored one full of great love, is going to another world, leaving his own children behind him, why then could not I who am not yet full of love and compassion go to another world following Buddha's steps? Who can blame me?' When finished uttering these words, Aṣvaghosha gazed at the pupil of Buddha's eye and gradually passed out of life. (2) The *變化功德契經* *Pien hua kung tê ch'i ching* (*Vikriyāpūnyasūtra?*) says : Then the Bhagavat said to Aṣvaghosha : 'Three hundred years after my Nirvāna thou shalt obtain an inspiration from me and with various methods (*upāya*) benefit and make happy all beings in coming generations. When thou dost not have any inspiration from me, thou canst not do this by thyself.' (3) The *摩訶摩耶契經* *Mahāmāyāśūtra* says as follows : 'When six hundred years are passed after the disappearance of the Tathāgata, ninety-six different schools of the *trīthakas* will arise, and professing false doctrines, each will struggle against the other to destroy the law of Buddha. A Bhikshu called Aṣvaghosha, however, will in an excellent manner proclaim the essence of the Dharma and defeat all followers of the *trīthakas*. (4) In the *常樂三昧契經* *Ch'ang tê san mei ch'i ching* (*Sūtra on the Samādhi of Eternal Merit*) we read : In the eight-hundredth year after the Nirvāna there will be a wise man, Aṣvaghosha by name. Among the followers of the *trīthakas* as well as those of Buddhism, he will refute all those who cherish heretical views and will establish the Dharma taught by Buddha. (5) In the *摩尼清淨契經* *Mo ni ch'ing ching ch'i ching* (*Mapivimālaśūtra?*) is said thus : About one hundred years after the Nirvāna of Buddha Aṣvaghosha Mahāsattva will appear on earth, protect the right doctrine and safely hoist the banner of Buddhism. (6) In the *勝因王契經* *Shêng ting wang ch'i ching* (*Çrīmūrdharajāśūtra?*) is said thus : On the seventeenth day after the enlightenment of Buddha there was a *trīthaka* called *迦羅堵鳩尸摩*

ecy in the Mahâmâyâ-sûtra. Nâgârjuna even states that he was a disciple of Açvaghosha, but the work itself is regarded as spurious, on account of some obvious contradictions, though the followers of the Mantra sect (*Shingonshyû*) insist on its genuineness because they are anxious to have an ancient authority for their own mystic doctrines, which are here supported.

Deeply absorbed in metaphysical speculation, the inhabitants of India paid very little attention to history, and whenever we endeavor to ascertain the date of important historical figures, we are sure to find our way to certainty barred. So we cannot decide which of the conflicting traditions above enumerated is to be considered as authentic. When taken independently of other historical events which are connected with them and whose dates have been already fixed, they have no value whatever. Besides it should be observed, the chronology of Buddha, to which every one of the traditions makes reference, is as yet unsettled and must have been still more so at the time when those traditions were current in India as well as in China. If they differed as to the date of Buddha, they might have maintained the same date for Açvaghosha; no one can tell. We have to seek a light from another source.

Another group of traditions centering around Açvaghosha is his connexion with a most powerful king of *Yüeh chih* 月氏國, who established his extensive kingdom in North-Western India. Who was this king? In the 雜寶藏經 *Tsa pao tsang ching* (Samyuktaratnapiṭaka-

Chia-lo-no-chiu-shih-to (Kâlanakshiṭa?), who transforming himself into the figure of a great *ndgardja* (i. e., snake-king) with 86,000 heads and 86,000 tongues, simultaneously proposed 86,000 contradicting questions and asked the Tathâgata [for the solution]. He then gave him a triple answer explaining all those paradoxes. The *ndgardja* then proposed tenfold questions again asking the Tathâgata [for their solution] to which he gave a hundredfold answer and explained their paradoxes. When this dialogue came to an end, Buddha said to the *ndgardja*: 'Very good, very good, O Açvaghosha Crâmanâ! in order to guard the castle of the Dharma, thou hast assumed this form of destruction, establishing the doctrine of Buddha. Be patient, be patient, always discipline thyself in this way, always behave thyself in this way, do not go round in a small circle, but make a universal tour.' The *ndgardja* then abandoning his assumed beast-form revealed his own real character and approaching the peerless, honored one and saluting him said rejoicingly in verse, etc., etc. This is the sixth Açvaghosha."

sūtra?)¹ *fas.* 7 we read: "A king of Tukhāra, Candana Kanishṭha² (or Kanīta? Chinese 旃陀尼陀 *chan-tan-chi-ni-ch'a*) had a close friendship with three wise men: the first one was a Bodhisattva, called Aṣvaghosha; the second, a minister of state called Mo-cha-lo (Mathara or Maṭara?); the third, an experienced physician called Chē-lo-chia (Caraka). With these three the king was on most intimate terms and treated them with the utmost cordiality, permitting them to approach his person. Aṣvaghosha said [one day] to him that if he [the king] would follow his advice, he would obtain in his coming life everything that was good, eternally put an end to all his misfortunes and forever be free from evil." . . .³

Aṣvaghosha's relation with King Candana Kanishṭha (or Kanīta? Chinese *Chi-ni-ch'a*) is told also in the *Fu fa tsang yin yüan ch'uān*,⁴ *fas.* 5:

"[At that time] the king of Tukhāra was very powerful. He was called Candana Kanishṭha (or Kanīta?, Chinese *Chi-ni-ch'a*). Being very ambitious and bold, and far superior in courage to all his contemporaries, every country he invaded was sure to be trampled down under his feet. So when he advanced his four armies

¹ *Sutra on the Casket of Miscellaneous Jewels*. The original Sanskrit author is unknown. Translated into Chinese by Chi-chia-yeh (吉迦夜 Kimkara?) of the Western country and T'an-yao 畫曜, A. D. 472. 8 *fasciculi*. The original text is said to have existed at the time when the *Chēng-yüan* catalogue 貞元集 was compiled (A. D. 785-804) by Yüan-chao 圓照, a Buddhist priest of the Tang 唐 dynasty (A. D. 618-907).

² Does Kanishṭha, which literally means "youngest," refer to the youngest of the three brothers who successively governed the Tukhāra district of India? If so, there is no question about the identity of him and King Kanishka.

³ The *Fu fa tsang ch'uān* ("Transmission of the Dharmapitaka," *fas.* 5) also seems to refer to the same tradition, for it is stated that when a king of Tukhāra (probably, Kanishka) was very much afflicted on account of his having committed many atrocious deeds in the war with Parthia (Eastern Persia), Aṣvaghosha told him that if he would follow the Dharma with a sincere heart, his sin would gradually be attenuated; and also that the same king had a physician called Caraka "who thoroughly understood pharmacy and who was clever, learned, intelligent, elegant, meek and compassionate," etc.

⁴ 付法藏因緣傳 "Accounts Relating to the Transmission of the Dharmapitaka." 6 *fasciculi*. The original Sanskrit author is unknown. The third Chinese translation now existent is by Chi-chia-yeh (Kimkara?) of the Western country, A. D. 472. The original text is said to have been existing when the *Chēng yüan* catalogue (A. D. 785-804) was compiled.

towards Pâtaliputra (*Hua shih ch'eng* in Chinese), the latter was doomed to defeat in spite of some desperate engagements. The king demanded an indemnity of 900,000,000 gold pieces, for which the defeated king offered Açvaghosha, the Buddha-bowl and a compassionate fowl, each being considered worth 300,000,000 gold pieces. The Bodhisattva Açvaghosha had intellectual powers inferior to none; the Buddha-bowl having been carried by the Tathâgata himself is full of merits; the fowl being of compassionate nature would not drink any water with worms in it,—thus all these having merits enough to keep off all enemies, they are on that account worth 900,000,000 gold pieces.¹ The king [of Tukhâra] was greatly pleased at receiving them and immediately withdrawing his army from the land went back to his own kingdom."

We have the same legend stated in a brief biography² of Açvaghosha as follows :

"After that a king of the smaller *Yüeh chih* country (i. e., Tukhâra) in North India invaded the Middle country (i. e., Magadha). When the besieging had continued for some time, the king of Central India sent a message [to the invader] saying: 'If there be anything you want, I will supply it; do not disturb the peace of my people by thus long staying here,' to which this reply was given: 'If you really ask a surrender, send me 300,000,000 gold pieces; I will release you.' The [besieged] king said: 'Even this entire kingdom cannot produce 100,000,000 gold pieces, how can I supply you with 300,000,000?' The answer was: 'There are in your country two great treasures, (1) the Buddha-bowl,³ (2) a Bhikshu of wonderful talent (i. e., Açvaghosha). Give them to

¹ This is a comical feature of the legend, for if these treasures could ward off all enemies why did they not protect the unfortunate king of Pâtaliputra against Kanishtha?

² *Life of Açvaghosha* 馬鳴菩薩傳, translated into Chinese by Kumârajîva. Very short. The author is unknown. The original Sanskrit text is stated in the *Chêng yüan* catalogue to have been existing at that time. Cf. *Wassijew's Buddhismus*, German ed., p. 231 et seq.

³ Fa-hien 法顯 states Kanishka (which is transliterated by him into Chinese *Chi-ni-chia* 闍那迦, corresponding to Sanskrit Kanika) as if a different person from the king of *Yüeh chih* who invaded Gandhâra to get the Buddha-bowl. *Vide* Legge's translation of *Fa-hien* pp. 33 and 34.

me, they are worth 300,000,000 gold pieces.' The [besieged] king said: 'Those two treasures are what I most revere, I cannot give them up.' Thereupon the Bhikshu said to the king in explanation of the Dharma:

"All sentient beings are everywhere the same, while Buddhism, deep and comprehensive, aims at universal salvation, and the highest virtue of a great man consists in delivering [all] beings. As our temporal administration is very liable to meet obstructions even your rule does not extend itself outside of this one kingdom. If you on the other hand propose a wide propagation of Buddhism, you would naturally be a *Dharmarāja* over the four oceans. The duty of a Bhikshu is to save [all] the people and not to give preference to one or the other. Merits lie in our heart; truth makes no distinction. Pray be far-sighted, and do not think only of the present.'

"The king who was from the first a great admirer of him, respectfully followed his advice and delivered him to the king of *Yüeh chih* who returned with him to his own kingdom."

Comparing all these traditions, we are naturally led to the conclusion that *Acvaghosha*, who was numbered as one of the four suns¹ of Buddhism, must have had a very powerful influence over the spiritual India of the time, that the king who wished to have him as a spiritual adviser must have been a very devoted Buddhist so as to accept a Bhikshu instead of an enormous sum of money, and that such a devoted Buddhist king, ruling over the vast domain which extended from the bank of the Indus towards the lower Ganges, must have been living sometime between the third and sixth century after the Nirvâna, whatever the authentic date of Buddha might be. The next conclusion we can advance therefore will be the identification of this king who is called *Candana Kanishtha* or *Kanita* in the above stories, with *Kanishka*,² the originator of the third Buddhist convocation in Kashmir.

As to the difference of the name, we have to say this. While

¹ Hsüen-tsang's 立辨, *Records of Western Countries*, Beal's English translation, Vol. II., p. 302.

² A. D. 85-106, according to M. Müller.

Hsüen-tsang's transliteration for Kanishka is *Chi-ni-shé-chia* 達臘色迦 which is quite an approximate reproduction of the original sounds, the Chinese method of transliteration before his time by the so-called "old translators" was rather irregular, loose and therefore often misleading. Add to this the liability to error on the part of local dialects, and we do not improperly identify *Chi-ni-ch'a*, with Kanishka, while the former may be Sanskritised *Kanishtha* or *Kanita*.¹

In further support of this view, we quote from the *Journal of the Buddhist Text Society*, Vol. I., Part 3, an article on King Kanishka, taken from a Tibetan source, which bears a more historical appearance than the legends above referred to. The abstract is:

"Kanishka, king of Palhāva and Delhi,² was born four hundred years after the Nirvāna. When he learned that Simha, king of Kashmir, abandoned the worldly life to become a Buddhist priest under the name of Sudarçana and obtained Arhatship, he went to Kashmir and heard a sermon delivered by Sudarçana.³ At that

¹ One objection to identifying *Chi-ni-ch'a* 蘭尼陀 (Kanishtha or Kanita) with Kanishka 達臘色迦 is a single Chinese character appearing in the *Mahālamkāra-çāstra* ("Book of Great Glory"), the work ascribed to Açvaghosha. In *fas.* 3 as well as *fas.* 6 of the same book referring to Candana Kanishtha or Kanita, the writer says: "我昔嘗聞旃檀陀尼陀 *Wo hsi ch'ang wén, chan-t'an chi-ni-ch'a wang*," i. e., "I heard of old that King Chandana Kanishtha," etc. (in *fas.* 6., *chi-na-ch'a*, etc., etc. The Chinese character *hsí* usually means "of yore" or "in olden times," but it also signifies the past indefinitely, near as well as distant. If we thus understand the term in the sense of "some time ago," or simply "once," there will be no difficulty in demonstrating that Açvaghosha was an elder contemporary of Kanishka, though we cannot apparently accept the Chinese tradition which says they were intimately known to each other. Because in that case Açvaghosha would not refer to the king in such a hearsay manner as stated in the book above mentioned. Taking all in all, this does not prevent us asserting that they were contemporaneous.

² Cf. A. Schieffner's German translation of Tārānātha's *History of Buddhism*, p. 89: "Nachdem König Cṛitschandra die Herrschaft ausgeübt hatte, waren viele Jahre vergangen, als im Westen im Lande *Tili* und *Mālava* ein an Jahren junger König Kanika in die Herrschaft gewählt wurde."

³ Tārānātha's statement differs from this. According to him Kanika and Kanishka are not the same king, the former being that of *Tili* and *Mālava*, while the latter that of *Jālamdhara*. *Vide* pp. 58 and 90. Tārānātha might have confused them.

time a Mahâyâna priest who kept a most prominent position in northern countries was called Açvaghosha. His influence in the spiritual world was as incomparable as the temporal power of Kanishka who conquered Kashmir and Jâlamdhara. The king sent a message to Açvaghosha to come to his kingdom, who, however, owing to his old age, could not accept the invitation, but sent him a leading disciple of his called Jñâna-yâca, accompanied with a letter treating the essential points of Buddhism."¹

Though the Tibetan tradition considerably differs in many respects from the Chinese accounts above mentioned, they both agree in this point that Açvaghosha and Kanishka had some intercourse, or that at least they were contemporaneous and known to each other. So we may take it as an established fact that Açvaghosha, the author of the 大乘起信論 *Mahâyâna-çraddhotpâda-çâstra* (*Discourse on the Awakening of Faith in the Mahâyâna*), was living at the time of Kanishka.²

I do not think there is any need here to enumerate all different opinions about the time of Kanishka, which has been already approximately fixed by the untiring investigation of European scholars, such as Princep, Lassen, Cunningham, Wilson, Fergusson, Max Müller, and others.³ So long as our present aim is to assign the time of Açvaghosha more definitely than stating vaguely some three or five hundred years after the Nirvâna of Buddha, suffice it to say that he lived at the time extending from the latter half of the first century before Christ to about 50 or 80 A. D. If we fix the date of Buddha's death in the fifth century before Christ, Açvaghosha must be said to have lived mostly during the six hundredth year

¹ Târanâtha also states this event (*Geschichte des Buddhismus*, p. 92). But the king is not Kanishka, but Kanika; and the name of the disciple is not Jñâna-yâca, but *Dschnânakriya*.

² A further corroboration of this view will be met with when we treat later on of the conversion of Açvaghosha by Parçva or his disciple Punyayâcas.

³ Max Müller's opinion, as stated before, is that Kanishka lived A. D. 85-106; Lassen thinks the Gondopharean dynasty was succeeded by Kanishka, king of the *Yueh chih*, about one hundred years before Christ; Princep places his reign during the first century A. D.; Cunningham thinks his consecration was 58 A. D., Fergusson, 79 A. D.; Rhys Davids, about 10 A. D., etc.

after the Nirvâna. At the very most his time cannot be placed later than the first century of the Christian era.

I have spared no pains, even at the risk of tediousness, in gathering all the information obtainable from Chinese sources relative to the date of Aćvaghosha, because this date is of paramount importance when we enter into the discussion of the development of the Mahâyâna Buddhism, which is commonly and erroneously considered to be the sole work of Nâgârjuna.

NATIVITY AND PEREGRINATION.

There is not so much discordance in the traditions about the wanderings of Aćvaghosha as about his date, though indeed we do not have as yet any means of ascertaining his birth-place, other than the statements of discordant authorities. According to Târanâtha,¹ he was a son of a rich Brahman called Samghaguhya who married the tenth and youngest daughter of a merchant in Khorta. As a youth, when thoroughly familiar with every department of knowledge, he went to Odivîça, Gaura, Tîrahuti, Kâmarûpa, and some other places, defeating everywhere his Buddhist opponents by his ingenious logic.

All these places are situated in Eastern India, and among the Chinese traditions the "Record of the Triratna" (*Li tai san pao chi*) as well as the "Accounts of Buddha and the Patriarchs" (*Fo tsu tung chi*) agree with Târanâtha in placing Aćvaghosha's native land in the East; but the *Life of Vasubandhu* makes Aćvaghosha a native of Bhâshita in Çrâvasti, while in Nâgârjuna's work, the *Mahâyâna-çâstravyâkhyâ* 釋摩訶衍論 (*Shih mo ho yen lun*), he is mentioned as having been born in Western India, Loka being the father and Ghoṇâ the mother. The "Record of Buddha and the Patriarchs Under Successive Dynasties" (*Fo tsu li tai t'ung tsai*) agrees with neither of the above statements, for it says (*fas. 5*): "The twelfth patriarch, Aćvaghosha Mahâsattva (the great man), was a native of Vârânaśi." A further contradicting tradition is pointed out by Prof. S. Murakami in one of his articles on the history of Buddhism,²

¹ *Geschichte des Buddhismus*, p. 90.

² *The Bukkyô Shirin*, Vol. I., No. 6. 1894. Tokyo, Japan.

quoting the *Shittansō* 題叢叢 (fas. 1), which makes Aćvaghosha a man of South India.

A majority of the traditions place his native country in East India; but there is no means of confirming these. One thing, however, seems to be certain, namely, that Aćvaghosha was not born in the northern part of India, which place is supposed by most Western Buddhist scholars to be the cradle of the Mahāyāna school.

Wherever the native country of Aćvaghosha may have been, both the Chinese and Tibetan records agree that he made a journey to Central India, or Magadha. It seems that every intellectual man in India, the people of which, living in affluence, were not occupied with the cares of making a living, sought to gain renown by dialectics and subtle reasonings, and Aćvaghosha, as a Brahman whose "intellectual acquirements were wonderfully deep," and whose "penetrating insight was matchless,"¹ could not resist the temptation. Not satisfied with his intellectual campaign against commonplace Buddhists in his neighborhood, who were crushed down as "rotten wood before a raging hurricane,"² he went, according to a Chinese tradition, to Pāṭaliputra, and according to the Tibetan, to Nālanda. The *Life of Aćvaghosha* evidently refers to this fact when it states that Pārçva, the eleventh patriarch and eventual teacher of Aćvaghosha, on being informed of the paramount influence of the Brahman *tīrthaka* (i. e., Aćvaghosha) in Central India and of the fact that his conquest over Buddhists had silenced the bell (*ghanta*) in some monastery (*vihāra*), journeyed from Northern India to convert the bitterest opponent into a faithful follower of Buddha. He adds that Aćvaghosha left his home and lived henceforth in Central India. But according to the "Transmission of the Dharmapitaka" (*Fu fa tsang ch'uan*, fas. 5) we find Aćvaghosha even after his conversion still in Pāṭaliputra, from which he was taken by King Kanishka to the latter's own capital, Gandhāra, in the Northwest of India.

¹ The "Transmission of the Dharmapitaka" (*Fu fa tsang ch'uan*, fas. 5).

² The same as above.

Thus all that we can say about the birth-place and wandering of Aṣvaghosha is: (1) he was a Brahman by birth either of South, or of West, or of East, but not of North India; (2) he acquired in Central India his highest reputation as a Brahman disputant, and, after his conversion, as the greatest Buddha-follower of the time, intellectually as well as morally; (3) his later life was spent according to the Chinese authority in the North where he wrote probably the *Mahālamkāra-sūtraçāstra* ("Book of Great Glory") which describes matters mostly relating to Western India.

APPELLATIONS.

The author of the *Mahāyānaçraddhotpādaçāstra* ("Discourse on the Awakening of Faith in the *Mahāyāna*") is most commonly known in the Chinese Buddhist literature by the name of Aṣvaghosha. But according to his *Life* he was also called *Kung-tê-jih* 功德日 (i. e., merit-sun; in Sanskrit, *Punyaditya*?). For he was not only a philosopher, but a preacher and an organiser, for "while in North India he widely propagated the doctrine of Buddha, led and benefited the masses, and through good and excellent [missionary] methods perfected the merits of the people." The *Record of Buddha and the Patriarchs* (*Fo tsou t'ung tsai*), where it is stated that his other name was *Kung-chang* 功勝 (*Punyaçrīka*?), can be said almost to agree with the above. While thus no other name or appellation of his is known in China, Tāranātha mentions nine more names: *Kāla* (Time), *Durdarsha* (Hard-to-be-seen), *Durdarshakāla* (Hard-to-be-seen-time), *Mātrceta* (Mother-child), *Pitrceta* (Father-child), *Çūra* (Hero), *Dharmika-Subhūti* (Virtuous-Mighty), and *Maticitra* (Intelligence-bright).¹

In I-tsing's "Correspondence from the South Sea" (*Nan hai chi kuei ch'uan*,² Chap. 32, "On Chanting"), the name *Mātrceta* is mentioned, but I-tsing does not identify him with Aṣvaghosha, though the legend attached to the former closely resembles that of the lat-

¹ *Geschichte des Buddhismus*, p. 90.

² 南海寄歸傳 by I-tsing 義淨 who left China A. D. 671 for a pilgrimage to India and came back A. D. 695. The book is a work on the *vinaya* as observed by the Sarvāstivādin, which the pilgrim witnessed in India as well as in Ceylon. An English translation by J. Takakusu, London.

ter told in Târanâtha. Târanâtha states that when Aćvaghosha became a *sthavira* and advocate of the Tripitaka, he had a dream one night in which the venerable Târâ gave him the instruction to write hymns on Buddha for the expiation of his former sinful deeds; that according to this admonition he wrote many hymns praising the virtues of Buddha, amongst which one containing one hundred and fifty clokas¹ is the best of all; that the hymns composed by him are full of benediction like the very words of Buddha, because he was predicted by the Blessed One to be a hymnist.²

Compare the above with this from I-tsing :

“The venerable Mâtrceta (Mother-child) was a man of great intellect, of excellent virtue, eminently standing above all sages in India. A tradition says that when Buddha was taking a walk one time with his kinsmen, disciples, and many other people, a nightingale (?), observing his personal feature as elegant and majestic as a gold mountain, uttered in the wood some pleasant, harmonious notes that sounded like praising the virtues of Buddha. Buddha then turning towards the disciples said: ‘The bird overcome by the joy of seeing me utters a pitiful cry. By this merit it will after my death obtain a human form, Mâtrceta 摩姪哩制陀 by name, and praise and adore my intrinsic virtues with a number of hymns.’ This man first followed the doctrine of a *tirthaka* worshipping Maheçvara³ and composed many hymns to adore him. But in the meantime he came across his own name recorded [in a Buddhist writing]; inspired by this, he took refuge in Buddha, changed his garb, abandoned his laymanship, and in many ways praised, honored and adored Buddha. Regretting his misbehavior in the past and desiring to perform good deeds in the future and also lamenting the unfortunate fate that prevented him from having a personal interview with the Great Teacher rather than bowing before his bequeathed image, he at last decided with all his rhetorical talent and

¹ Schiefner notes: “Çatapantschâcatika nâma stotra, Tandjur B. 1, unter den Stotra's.”

² *Geschichte des Buddhismus*, p. 91.

³ Cf. the following statement in Târanâtha, p. 90: “Als er (Aćvaghosha) in den Mantra- und Tantra-Formeln und in der Dialektik sehr bewandert wurde, gab ihm Maheçvara selbst Anleitung.”

in solemn fulfilment of the Lord's prophecy, to praise his virtues and merits [in hymns]. He first composed four hundred clokas (verses) and then one hundred and fifty clokas;¹ all of which describe the six Pāramitās [Perfections] and state the excellent virtues possessed by the World-Honored-One," etc.

At the end of the same Chapter (i. e., Chap. 32) in I-tsing's Correspondence he refers to Aṣvaghosha and Nāgārjuna both of whom composed some beautiful and popular hymns that were sung by Buddhists throughout India at the time of his pilgrimage. But if the Tibetan statement is reliable, I-tsing may have been mistaken in recording Aṣvaghosha and Mātrceta as different characters. The Tibetan and Chinese version of the one hundred and fifty cloka hymn being still existent, the comparison of which, however, I have not yet been able to make, will furnish an interesting testimony for the identification.

Many legendary explanations have been invented about the name of Aṣvaghosha, as might be expected of the imaginative Indian mind, but not being worth while quoting from the materials at my command, no reference will be made to them here.

CONVERSION.

A consensus of traditions both Tibetan and Chinese maintains that Aṣvaghosha was in his earlier life a most powerful adherent of Brahmanism, though we are tempted to discredit it on the ground that later Buddhist writers may have wished to exaggerate the superiority of Buddhism to all other Indian philosophical and religious doctrines, by chronicling the conversion of one of its strongest opponents to their side. Whatever the origin of the legend may be, how did his conversion take place? By whom was he converted? About these points the Tibetan and the Chinese tradition by no means agree, the one standing in a direct contradiction to the other. While the Tibetan account is full of mystery and irra-

¹ "Hymn of One Hundred and Fifty Clokas" (Çatapāñcāśad-buddhastotrā), translated into Chinese by I-tsing during his stay in the Nālandā-vihāra, Central India. At the time of the compilation of the *Chēng yuān* catalogue the original is said to have existed.

tionality, the Chinese is natural enough to convince us of its probable occurrence.

According to Târanâtha¹ Âryadeva, the most eminent disciple of Nâgârjuna, defeated and proselyted Açvaghosha,² not by his usual subtlety in dialectics, but by the superiority of his magical arts. Açvaghosha made use of every tantric formula he could command, in order to free himself from the enchantment in which he was held by his enemy, but all to no purpose whatever. Thus when he was in an utterly desperate condition, he happened to read the Buddhist Sûtra which was kept in his place of confinement and in which he found his destiny prophesied by Buddha,³ he was seized with deep regrets for his former hostile attitude toward the Dharma, and immediately renouncing his tîrthakism, professed the doctrine of Çâkyamuni.

The Tibetan tradition presents some unmistakable indications of a later invention: the use of tantric formulæ, the so-called prophecy of the Tathâgata, and the anachronism of Âryadeva. On the other hand the Chinese records are worth crediting, though they are not unanimous as to how the conversion took place and who was the proselytist.

According to the *Life of Açvaghosha*, Parçva⁴ was the man who converted him. They agreed at their first meeting that on the seventh day thence they should have the king, ministers, Çrâmanas, tîrthakas and all great teachers of the Dharma gathered in the *Vihâra* and have their discussion there before all those people. "In the sixth night the sthavira entered into a *samddhi* and meditated on what he had to do [in the morning]. When the seventh day dawned, a great crowd was gathered like clouds. The Sthavira Parçva arrived first and ascended a high platform with an unusually pleasant

¹ *Geschichte des Buddhismus*, German translation by Schieffner, pp. 84-85.

² He is mentioned there by the name of Durdarshakâla.

³ Cf. this with the accounts of Mâtrîcetâ-Açvaghosha told in I-tsing.

⁴ The conversion of Açvaghosha by Parçva as here stated may be considered an addition to the proof already demonstrated for the contemporaneousness of Açvaghosha and King Kanishka; for Parçva, according to the Tibetan as well as the Chinese authority, was a co-operator at least, if not the president, of the third Buddhist convocation promoted by the king of Kashmir.

countenance. The *tīrthaka* [i. e., Açvaghosha] came later and took a seat opposite him. When he observed the çrāmanā with a pleasant countenance and in good spirits, and when he also observed his whole attitude showing the manner of an able opponent, he thought : 'May he not be Bhikshu Chin? His mind is calm and pleasant, and besides he bears the manner of an able antagonist. We shall indeed have an excellent discussion to-day.'

"They then proposed the question how the defeated one should be punished. The *tīrthaka* (Açvaghosha) said : 'The defeated one shall have his tongue cut out.' The sthavira replied 'No, he shall become a disciple [of the winner] as the acknowledgement of defeat.' The *tīrthaka* then replied : 'Let it be so,' and asked, 'Who will begin the discussion?' The Sthavira Parçva said : 'I am more advanced in age; I came from afar for the purpose [of challenging you]; and moreover I was here this morning earlier than you. So it will be most natural for me to speak first.' The *tīrthaka* said : 'Let it be so. Following the subject of your argument I shall completely baffle you.'

"The Sthavira Parçva then said : 'What shall we have to do, in order to keep the kingdom in perfect peace, to have the king live long, to let the people enjoy abundance and prosperity, all free from evils and catastrophes?' The *tīrthaka* was silent, not knowing what to reply. As now according to the rule of discussion one who could not make a response is defeated, Açvaghosha was obliged to bow [before the opponent] as a disciple of his. He had his head shaved, was converted to a çrāmanā, and instructed in the perfection-precepts.

"When he (Açvaghosha) was alone in his room, he was absorbed in gloomy, unpleasant reflexion as to why he, possessing a bright intellect and far-sighted discretion, and having his reputation widely spread all over the world, could be defeated with a single question and be made a disciple of another. Parçva well knew his mind and ordered him to come to his room where the master manifested himself in several supernatural transformations. Açvaghosha now fully recognised that his master was not a man of ordinary

type, and thus feeling happy and contented, thought it his duty to become one of his disciples.

"The master told him: 'Your intellect is bright enough, hard to find its equal; but it wants a final touch. If you study the doctrine I have mastered, attend to my capability and insight into the Bodhi, and if you become thoroughly versed in the method of discussion and clearly understand the principle of things, there will be no one who can match you in the whole world.'

"The master returned to his own country [North India]; the disciple remained in Central India, making an extensive study of the Sūtras, seeking a clear comprehension of the doctrine, Buddhistic as well as non-Buddhistic. His oratorical genius swept everything before him and he was reverentially honored by the four classes of the people, including the king of [Central] India who treated him as a man of distinction."

According to the "Transmission of the Dharmapiṭaka" (*Fu fa tsang chuan*), however, Aṣvaghosha was not converted by Parṣa, but by his disciple and patriarchal successor, Puṇyayaṭas. Though the two works, *Life of Aṣvaghosha* and the book just mentioned differ in some other points, they are evidently two different versions of the one original legend. As the book is not as yet accessible to English readers, I here produce the whole matter translated from the Chinese version. The comparison will prove interesting.

"Full of a proud and arrogant spirit that speedily grew like a wild plant, he [Aṣvaghosha] firmly believed in the existence of an ego-entity and cherished the ultra-egotistic idea. Being informed that an Ācarya called Puṇyayaṭas, who, deep in knowledge and wide in learning, proclaimed that all things are relative [=cānya, lit. empty], there is no *atman*, no *pudgala*; Aṣvaghosha's arrogant spirit asserted itself, and presenting himself to Puṇyayaṭas challenged him saying: 'I confute all [false] opinions and doctrines in the world, as hailstones strike tender grass. If my declaration prove false and not true, I will have my own tongue cut out in acknowledgement of defeat.' Thereupon Puṇyayaṭas explained to him that Buddhism distinguishes two kinds of truth, that while 'practical truth' hypothetically admits the existence of an *atman*, there is

nothing conditional in 'pure [or absolute] truth,' all being calm and tranquil, and that therefore we cannot prove the ego as an absolute entity.

"Açvaghosha would not yet surrender himself, because being over-confident of his own intellectual power, he considered himself to have gained the point. Puṇyayaṭas said: 'Carefully think of yourself; tell not a lie. We will see which of us has really won.'

"Açvaghosha meanwhile came to think that while 'practical truth' being only conditional has no reality at all, 'pure truth' is calm and tranquil in its nature, and that therefore these two forms of truth are all unobtainable, and that if they have thus no actuality (or existence?), how could they be refuted [as false]?¹ So feeling now the superiority of his opponent, he tried to cut out his tongue in acknowledgement of the defeat. But Puṇyayaṭas stopped him saying: 'We teach a doctrine of love and compassion, and do not demand that you cut out your tongue. Have your head shaved instead and be my disciple.' Açvaghosha thus converted was made a çrāmanā by Puṇyayaṭas.

"But Açvaghosha who felt extremely ashamed of his [former] self-assumption was thinking of attempting his own life. Puṇyayaṭas, however, attaining arhatship, entered into a *samddhi* and divined what was going on in the mind of Açvaghosha. He ordered him to go and bring some books out of the library. Açvaghosha said to the *Ācarya*: 'The room is perfectly dark; how can I get in there?' To this Puṇyayaṭas answered: 'Just go in, and I shall let you have light.' Then the *Ācarya* through his supernatural power stretched far into the room his right hand whose five fingers each radiating with light illuminated everything inside of the walls. Açvaghosha thought it a mental hallucination and knowing the fact that a hallucination as a rule disappears when one is conscious of it, he was surprised to see the light glowing more and more. He

¹ The reasoning is somehow unintelligible. The passages must be defective, and although I might venture to supply the necessary words to make them more logical and intelligible to the general reader who is not acquainted with the cūyatā philosophy, I have not tried to do so, thinking that it is enough here if we see in what the subject of the discussion consisted.

tried his magical arts to extinguish it till he felt utterly exhausted, for the mysterious light suffered no change whatever. Finally coming to realise that it was the work of no other person than his teacher, his spirit was filled with remorse, and he thenceforth applied himself diligently to religious discipline and never relapsed.¹

The "Record of Buddha and the Patriarchs" (*Fo tsou tung tsai*) agrees with the "Transmission of the Dharmapiṭaka" (*Fu fa tsang chuan*) in making Puṇyayaças, instead of Parçva, the master of the conversion. But the former does not state how Aćvaghosha was converted.

Though so far it remains an open question who was the real master of Aćvaghosha, we can be sure of this, that he had intimate spiritual communication with both Parçva and Puṇyayaças. Parçva who was an older contemporary of Puṇyayaças, was probably already advanced in age when Aćvaghosha came to be personally acquainted with him, and so he did not have time enough to lead the young promising disciple to a consummate understanding of the doctrine of Buddha. After the demise of this venerable old patriarch, Aćvaghosha therefore had to go to Puṇyayaças for a further study of his religion, till he was capable of forming his own original thoughts, which are set forth in his principal work, the "Discourse of the Awakening of Faith" (Çraddhotpâda-Çâstra). This assumption is justified when we notice that Aćvaghosha in the "Book of Great Glory" pays his homage to Parçva as well as to Puṇyayaças.

Now by way of a supplementary note to the above, let us say a word about Wassiljew's observation² which states that while Hînayânists or Çrâvakas ascribe the conversion of Aćvaghosha to Parçva, the Mahâyânistic record says that Âryadeva converted him. This assertion is evidently incorrect, for the *Life of Aćvaghosha* as well as the "Transmission of the Dharmapiṭaka" (*Fu fa tsang chuan*) in which the honor of his conversion is given to the successor of Parçva as aforesaid, do not certainly belong to the work of

¹ The "Transmission of the Dharmapiṭaka" (*Fu fa tsang chuan*), fas. 5.

² *Buddhismus*, German ed., p. 222, and also see Târanâtha, tr. by Schieffner, p. 311.

the Hînayâna school. It is the Tibetan tradition only, and not the general Mahâyânist statement that Âryadeva converted Açvaghosha, and there is no ground at all for the assertion of Wassiljew, which practically leads us to take everything Tibetan for Mahâyânist and everything Chinese for Hînayânic.

LISTS OF PATRIARCHS.

The incorrectness of the Tibetan story, as to the conversion of Açvaghosha by Âryadeva above referred to, is further shown by a list of the Buddhist patriarchs in India appearing in various Buddhist books either translated from Sanskrit into Chinese or compiled in China from sundry sources. In every one of them Açvaghosha is placed after Parçva or Punyayaças, and before both Nâgârjuna and Âryadeva, the most brilliant disciple of the former. The following list therefore as we noticed elsewhere will furnish

	THE FO TSU T'UNG T'SAI	THE FO TSU T'UNG CHI	THE FU FA TSANG CHUAN	BUDDHABHADRAI	SARVASTI-VADIN
1	Mahâkâçyapa	Mahâkâçyapa	Mahâkâçyapa	Ânanda	Mahâkâçyapa
2	Ânanda	Ânanda	Ânanda	Madhyântika	Ânanda
3	Çaçavâsa	Çaçavâsa	Çaçavâsa	Çaçavâsa	Madhyântika
4	Upagupta	Upagupta	Upagupta	Upagupta	Çaçavâsa
5	Drñaka	Drñaka	Drñaka	Kâtyâyana	Upagupta
6	Micchaka	Micchaka	Micchaka	Vasumitra	Maitreya
7	Vasumitra	Buddhanandi	Buddhanandi	Krshna	Kâtyâyana
8	Buddhanandi	Buddhamitra	Buddhamitra	Parçva	Vasumitra
9	Buddhamitra	Parçva	Parçva	Açvaghosha	Krshna
10	Parçva	Punyayaças	Punyayaças	Ghosa	Parçva
11	Punyayaças	Açvaghosha	Açvaghosha	.....	Açvaghosha
12	Açvaghosha	Kapi	Kapimala	.....	Kumârata
13	Kapimala	Nâgârjuna	Nâgârjuna	.....	.....
14	Nâgârjuna	Nâgârjuna	.....	.....	.....
15	Kanadeva (Âryadeva)	Kanadeva	.....	.....	.....
...
34	.....	.....	.....	.....	.....
35	.....	.....	.....	.....	.....

¹ He was a native of Kapilavastu and came to China A. D. 406. A translator of many Sanskrit works. His list belongs to the Sarvâstivâdin, though it is a little different from the succeeding one. The former contains fifty-four and the latter fifty-three patriarchs. See the *Chu san tsang chi chi* 出三藏記集 by 僧祐 (Nanjo's Catalogue, No. 1476).

us good material for fixing the time of Aćvaghosha. It does not make any practical difference whether he was converted by Parçva himself or his immediate successor and disciple Punyayaças, because it is most probable they all were contemporaneous. The list generally gives twenty-three or twenty-eight patriarchs beginning with Mahākācyapa, but not deeming it necessary to give a complete list, I have cut it short at Deva.

Chieh-sung¹ refutes in his *Chuan fa chang tsung lun* 傳法正宗論 (A Treatise on the Right Transmission of the Dharma) the authority of the "Transmission of the Dharmapitaka" (*Fu fa tsang chuan*) but he agrees with it down to the seventeenth patriarch. The principal point of his refutation is simply that Bodhidharma, the founder of the Chinese Dhyāna school, should be included in the list.

AS AN ARTIST.

We cannot conclude the accounts concerning Aćvaghosha without mentioning an anecdote from a Chinese source.² The Çraddotpādaçāstra ("The Awakening of Faith,") proves he was a philosopher of a high grade; the Buddharatitakāvya ("The Life of Buddha") and the Mahālamkaraçāstra ("The Book of Great Glory") reveal his poetical genius; and the following story indicates that he was a musician:³

"He [Aćvaghosha] then went to Pātaliputra for his propaganda-tour, where he composed an excellent tune called *Lai cha huo lo* (賴陀和囉 Rāstavara?), that he might by this means convert the people of the city. Its melody was classical, mournful, and melodious, inducing the audience to ponder on the misery,

¹ 聖昇 a priest of the Dhyāna school who died A. D. 1071 or 1072. He wrote among other works one on the fundamental identicalness of Confucianism and Buddhism.

² The "Transmission of the Dharmapitaka" (*Fu fa tsang chuan*, fas. 5).

³ The fact agrees well with Tāranātha's statement which in its German translation reads as follows: "Die von ihm verfassten Loblieder sind auch in allen Ländern verbreitet; da zuletzt Sänger und Possenreisser dieselben vortrugen und bei allen Menschen des Landes mit Macht Glauben an den Buddha entstand, erwuchs durch die Loblieder grösserer Nutzen zur Verbreitung der Lehre." *Geschichte des Buddhismus*, German tr., p. 91.

emptiness, and non-âtman-ness of life. That is to say, the music roused in the mind of the hearer the thought that all aggregates are visionary and subject to transformation ; that the triple world is a jail and a bondage, with nothing enjoyable in it ; that since royalty, nobility, and the exercise of supreme power, are all characterised with transitoriness, nothing can prevent their decline, which will be as sure as the dispersion of the clouds in the sky ; that this corporeal existence is a sham, is as hollow as a plantain tree, is an enemy, a foe, one not to be intimately related with ; and again that like a box in which a cobra is kept, it should never be cherished by anybody ; that therefore all Buddhas denounce persons clinging to a corporeal existence. Thus explaining in detail the doctrine of the non-âtman and the *cānyatā*, Açvaghosha had the melody played by musicians, who, however, not being able to grasp the significance of the piece, failed to produce the intended tune and harmony. He then donned a white woolen dress, joined the band of musicians, beating the drum, ringing the bell, and tuning the lyre, and this done, the melody in full perfection gave a note at once mournful and soothing, so as to arouse in the mind of the audience the idea of the misery, emptiness, and non-âtman-ness of all things. The five hundred royal princes in the city thus moved all at once were fully awakened, and abhorring the curse of the five evil passions abandoned their worldly life and took refuge in the Bodhi. The king of Pâtaliputra was very much terrified by the event, thinking that if the people who listen to this music would abandon their homes [like the princes], his country would be depopulated and his royal business ruined. So he warned the people never to play this music hereafter."

WORKS IN CHINESE TRANSLATIONS.

The works ascribed to Açvaghosha and still existing in Chinese translations are eight in number. They are : (1) The 大乘起信論 *Tai shéng ch'i hsin lun* (Mahâyânaçraddhotpâdaçâstra) : discourse on the awakening of faith in the Mahâyâna. It is the principal work of Açvaghosha, and through this we are able to recognise

what an important position he occupies in the development of the Mahâyânic world-conception and theory of final emancipation. Its outlines and the accounts of its Chinese translation will be given below. (2) The 大宗地文本論 *Ta sung ti hsüan wén pén lun*, a fundamental treatise on the spiritual stages for reaching final deliverance. The book has a decided tendency to mysticism, explaining a gradual development of religious consciousness through fifty-one different spiritual stages. It may be considered a precursory work out of which Vajrabodhi's Mantrism finally made a full manifestation. It was translated by Paramârtha between A. D. 557-569. Twenty *fasciculi*, forty chapters. (3) The 大莊嚴論經 *Ta chuang yen lun ching* (Mahâlamkârasûtraçâstra), the Book of Great Glory, or a compilation of stories illustrating the retribution of karma. The stories relate mostly to the events that occurred in Western India. Beal translated some of them in his *Buddhist Literature in China*. The Chinese translator is Kumârajîva, circa A. D. 405. Fifteen *fasciculi*. (4) The 佛所行讚 *Fo shu hing tsan* (Buddhacaritakâvya), a well known poem on the life of Buddha. The Chinese translation is by Dharmaraksha between A. D. 414-421. Five *fasciculi*, twenty-eight chapters. Beal's English translation forms Vol. XIX. of *The Sacred Books of the East*; and Cowell's translation from Sanskrit, Vol. XLIX of the same. (5) The 尼乾子問無我義經 *Ni kan tzü wén wu wu i ching*, a sûtra on a Nirgrantha's asking about the theory of non-ego. The book foreshadows the Mâdhyamika philosophy of Nâgârjuna, for the two forms of truth are distinguished there, Pure truth (*Parmrtha-satya*) and Practical Truth (*Samvrtti-satya*),¹ and the Cânyaât theory also is proclaimed. (6) The 十不善業道經 *Shih pu shan yeh tao ching*, a sûtra on the ten no-good deeds. (7) The 事師法五十頌 *Shih shih fa wu shih sung*, fifty verses on the rules of serving a master or teacher. (8) The *Lu tao lun 'hui ching*, a sûtra on transmigration through the six states of existence. These last four works are very short, all translated by Jih-ch'êng (Divayâcas?), between A. D. 1004-1058.

¹ Notice Açvaghosha's discussion with Puñyayaças as above mentioned.

CHINESE TRANSLATIONS OF THE "DISCOURSE ON THE AWAKENING OF FAITH."

Let us give here some remarks on the Chinese translations of Aṣvaghosha's, principal and best known work "The Awakening of Faith." The Sanskrit original is long lost, probably owing to the repeated persecutions of Buddhism by Chinese emperors at different times. According to the *Chéng yüan* catalogue 貞元錄 (compiled between A. D. 785-804) the Sanskrit text is said to have existed at that time. It is a great pity that such an important Buddhist philosophical work as the present cāstra can be studied only through translations.

There are two Chinese translations still existing in the tripiṭaka collection. The first translation was made by Paramārtha (波羅末陀), otherwise called Kulanātha (獨羅那陀), of Ujjayana (or Ujjayini, modern Oujein) in Western India. He came to China A. D. 546 and died A. D. 569 when he was 71 years old. Among many other translations, the present one came from his pen on the tenth day of September, A. D. 554.

The second one is by Çikshānanda (實叉難陀), of Kusutana (Khoten), who began his work on the eighth of October, A. D. 700. He died in China A. D. 710 at the age of 59.

As to the problem whether the original of the two Chinese translations is the same or different, my impression is that they were not the same text, the one having been brought from Ujjayana and the other from Khoten. But the difference, as far as we can judge from the comparison of the two versions, is not fundamental.

In the preface to the second translation of the *Kao li* edition, the unknown writer states to the following effect: The present Cāstra has two translations. The first one is by Paramārtha and the second one is from the Sanskrit text brought by Çikshānanda who found also the older Sanskrit original in the *Tz'u an* tower. As soon as he had finished the rendering of the *Avatamsakasūtra* into Chinese, he began a translation of his own text with the assistance of several native Buddhist priests. The new translation occa-

sionally deviates from the older one, partly because each translator had his own views and partly because the texts themselves were not the same.

Though the *Chéng yüan* 成元錄 as well as the *K'ai yüan*¹ 開元錄 catalogue affirm that the two translations were from the same text, this can only mean that they were not radically divergent. For if any two editions differ so slightly as not to affect the essential points, they can be said to be practically the same text.

Which of the two translations then is the more correct? To this question we cannot give any definite answer as the originals are missing. The first translation has found a more popular acceptance in Japan, and probably also in China, not because it is more faithful to the original, but because a most learned and illustrious Buddhist scholar called Fa tsang 法藏 (A. D. 643-712) wrote a commentary on it. And on that account the commentary is more studied than the text itself. Fa tsang assisted Çikshānanda in preparing the second translation, but he preferred the first one for his commentary work, partly because the first one had already found a wide circulation and some commentators before his time, and partly because both translations agreeing in all their important points, he did not like to show his "partiality," as a commentator on Fa tsang says, to the one in the preparation of which he himself took part.

OUTLINES OF THE "DISCOURSE ON THE AWAKENING OF FAITH."

I cannot help saying a few words here about the importance of Aṣvaghosha's main work which is scarcely known in the West, and if so, wrongly. Even Samuel Beal who is considered one of the best authorities on Chinese Buddhism, makes a misleading reference to our author in his *Buddhism in China*. The following quotation from the same apparently shows that at least when he wrote it, 1884, he had a very insufficient knowledge of the subject. He says (p. 138):

¹A catalogue of Buddhist books collected in the K'ai yüan period (A. D. 713-741) of the Tung Dynasty, by 契嵩 Chih-shang, A. D. 730. Its full name is "K'ai yüan shih chiao lu." Twenty fasciculi.

"His (Açvaghosha's) writings still survive in a Chinese form, and when examined will probably be found to be much tinged by a pseudo-Christian element . . . But there is one book, the *K'i-sin-lun*, or 'Treatise for Awakening Faith,' which has never yet been properly examined, but, so far as is known, is based on doctrines foreign to Buddhism and allied to a perverted form of Christian dogma."

Wassiljew, another of the highest Western authorities on the subject, seems to be entirely ignorant of the existence of the present work. It is very strange that those who are considered to be quite well acquainted with the development of the Mahâyânic thought, do not place in the right light a prominent, if not the principal, actor, who, so far as is known to us, practically initiated this great spiritual and intellectual movement in India. Wassiljew says in his *Buddhismus* (pp. 83-84):

"Zu welcher besonderen Schule Açvaghosha gehörte, wird nicht mit Bestimmtheit überliefert: aus der Legende, nach welcher er sich bei der Abfassung der Vibhâshâ betheiligte, dürfen wir jedoch den Schluss ziehen, dass er zu den Repräsentanten der Vai-bhâschika's gerechnet ward."

It is true that in the *Life of Vasubandhu* Açvaghosha is said to have taken part in the compilation of the Vibhâshâ, but it is of no account whatever in the face of the present book in which we can clearly trace almost all elements of the thought fully developed afterwards by Nâgârjuna and other later Mahâyâna representatives.

I wish here, in order to show the significance of Açvaghosha, to call the attention of the reader to the three most salient points in his doctrine which will distinguish him from all Hînayâna schools. The three points constituting the gist of this Çâstra then are: (1) the conception of suchness (*Bhûtatathâtd*); (2) the theory of the triple personality; (3) the salvation by faith or the Sukhâvati doctrine.

The conception of suchness assumes other names, namely, "The Womb of the Tathâgata" (*Thatdgatagarbha*), when considered from its embracing all possible merits, and the All-Conserving Mind (*Âlaya-vijñâna*), when it becomes the principle of evolution

and is said to have developed from the teaching of Buddha as expounded in the old canonical sutras, such as the *Lankavatara* and the *Crīmadā*. Whatever the origin of the idea of suchness might have been, its "absolute aspect" evidently foreshadows the *Cūyatā* philosophy of the Mādhyamika school. It is very doubtful whether Nāgārjuna, as told in a Chinese tradition, was a personal disciple of Aćvaghosha, but it is highly probable that he was much influenced by him in forming his system.

The second thesis, the theory of the triple personality, that is one of the most distinctive characteristics of the Mahāyāna Buddhism, seems to have been first established by Aćvaghosha. The pantheistic idea of suchness (*Bhūtatathatā*), and the religious consciousness which always tends to demand something embodied in infinite love (*karund*) and infinite wisdom (*jñāna*), and the scientific conception of the law of causation regulating our ethical as well as physical world, or in short the doctrine of karma,—these three factors working together in the mind of Aćvaghosha culminated in his theory of the triple personality.

The doctrine of salvation by faith whereon the Japanese *Shin Shyū* and *Jōdō Shyū* laid down their foundation also, appears first in the present cāstra. If the quotation in the Mahāyāna-çraddhotpāda actually refers to the *Sukhāvati* sūtras, as we may fairly assume, there is a great probability in the statement that during the first four centuries after the Nirvāna there was already a variety of free interpretations about the teaching of the Master, which, commingled with the other religio philosophical thoughts in India, eventually made a full development under the generel names of the Mahāyāna and the Hīnayāna schools.

A supplementary point to be noticed in Aćvaghosha is the abundance of similar thoughts and passages with those in the *Bhagavatgīta*. The coincidence between the latter and the *Saddharma-puṇḍarīka* has been pointed out by Kern in his *Buddhismus und seine Geschichte* (Vol. II., p. 500, footnote). While it is an open question which of the two has an earlier date, the Mahāyāna Buddhism as a whole must be permitted to have some common points with the canonical book of Çivāism.

In conclusion I wish to state that as this book, the *Awakening of Faith*, is of paramount importance in its being the first attempt of systematising the fundamental thoughts of the Mahâyâna Buddhism, as well as in its forming a main authority of all the Mahâyânic schools, those who study the doctrinal history of Buddhism cannot dispense with it; and that, in spite of its highest importance, no attempt has yet been made to make it accessible to the reader who is not familiar with the Chinese language, and so it is my intention to offer to the public an English translation of the entire text.

TEITARO SUZUKI.

LA SALLE, ILL.

THE FOOD OF LIFE AND THE SACRAMENT.

THE BIBLICAL ACCOUNT AND PAGAN PARALLELS.

THE problem of the origin of death according to the religious solution of the Hebrews is treated in a legend preserved in the second and third chapters of Genesis. After the creation of man, Yahveh-Elohim planted a garden irrigated by four rivers and "full of trees pleasant to the sight and good for food ; the tree of life also in the midst of the garden, and the tree of knowledge of good and evil." The account continues :

"And the Lord God took the man, and put him into the garden of Eden to dress it and to keep it.

"And the Lord God commanded the man, saying, Of every tree of the garden thou mayest freely eat :

"But of the tree of the knowledge of good and evil, thou shalt not eat of it : for in the day that thou eatest thereof thou shalt surely die."

Here follows the report of the creation of animals and of Eve the woman taken from Adam's ribs. The story continues :

"Now the serpent was more subtil than any beast of the field which the Lord God had made. And he said unto the woman, Yea, hath God said, Ye shall not eat of every tree of the garden ?

"And the woman said unto the serpent, We may eat of the fruit of the trees of the garden :

"But of the fruit of the tree which is in the midst of the garden, God hath said, Ye shall not eat of it, neither shall ye touch it, lest ye die.

"And the serpent said unto the woman, Ye shall not surely die :

"For God doth know that in the day ye eat thereof, then your eyes shall be opened, and ye shall be as gods, knowing good and evil.

"And when the woman saw that the tree was good for food, and that it was

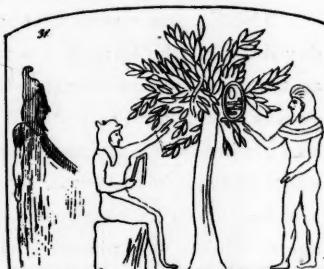
pleasant to the eyes, and a tree to be desired to make one wise, she took of the fruit thereof, and did eat, and gave also unto her husband with her; and he did eat.

" And the eyes of them both were opened, and they knew that they were naked ; and they sewed fig leaves together, and made themselves aprons."

The home of this legend undoubtedly is Chaldea, for the names *Eden*, as well as the rivers of *Eden*¹ are Chaldean, and the tree of life plays an important part in Chaldean mythology.² In fact, excavators have been so fortunate as to discover a great number of ancient stone tablets containing the original versions of Old Testament legends : the story of the Deluge ; the destruction of cities by rain and fire ; the creation of the world in six days ; the adventures



CHALDEAN SEAL CYLINDER.
(BRITISH MUSEUM.)



PICTURE DISCOVERED IN THE
RUINS OF THEBES.

ILLUSTRATIONS OF THE STORY OF THE FALL.

of King Sargon, who in his infancy (like Moses) was exposed in a basket of rushes on the river, but was saved to become the hero of his nation, etc. We have therefore every reason to believe that the story of the origin of death is also a Chaldean story, especially as the tree of life plays an important part in the sculpture of all the nations of Mesopotamia ; and an illustration of a man and a woman under

¹ Eden is the Accadian *edinna*, the Euphrates is the *Purrat* (or curving water), Hiddekel is Hid-Idikna (Hid means river in Accadian). The Hebrew Sabbath is an ancient Accadian institution ; *Sabattu* means "day of rest." Assyrian texts speak of it as "a day of rest for the heart," "a day of peace," "a day on which work is unlawful," or as "the completion of labors," etc.

² The story of the creation in Gen. i.-ii. 3 differs in many essential features from the report in Gen. ii. 4 et seq. Both are ultimately derived from Chaldea but the former is a younger importation. The latter had time to be adapted to the country and may therefore be called the Canaanitic account.

a tree, and a serpent behind the woman, has been discovered on an ancient Assyrian cylinder. A similar picture was discovered in the ruins of Thebes by Herr Norden, who published it in his *Journey to Egypt* (Table LVIII).¹ Considering the close connexion in which Egypt and Assyria stood at the age when the tables of Tell-el-Amarna were manufactured, it is quite probable that the idea of the origin of death being caused by the eating of some fruit should have been transferred to Egypt, and we are still inclined therefore to regard the Chaldean origin as the most probable.

We know that the tree spirit was worshipped in Egypt on account of its soul-preserving power.

The Egyptian soul is conceived in a twofold way as the *ka* or double, i. e., the form of a man's personality² (his *Ebenbild*), and as the *ba* or consciousness, the spirit that animates him. The *ka* was represented as a statue or image of a man, and each person had his individual *ka*, which was conceived as a kind of astral body and was thought to bestow "protection, intelligence, purity, health and joy" upon its bodily representative during its earthly pilgrimage.³ The *ba* was pictured as a hawk with a human head, which after death was supposed to take its flight up to Osiris or to hover near the body in the tomb.

How prominently the worship of the tree spirit was connected in ancient Egypt with the punishment of the soul appears from the fact that these three ideas, the *ba*, the *ka*, and the tree spirit, were the centre of the family religion of Egyptian life. Says Prof. W. M. Flinders Petrie:⁴

"Closely linked with the belief in the *ka* and *ba* was the worship of the tree spirit. In many representations we have the tree goddess in various forms,—human, cow-headed, or shown as a mere arm emerging from the branches of the

¹ The picture is here reproduced from Bishop Münter's work, *Sinnbilder und Kunstvorstellungen der alten Christen*, Altona, 1825.

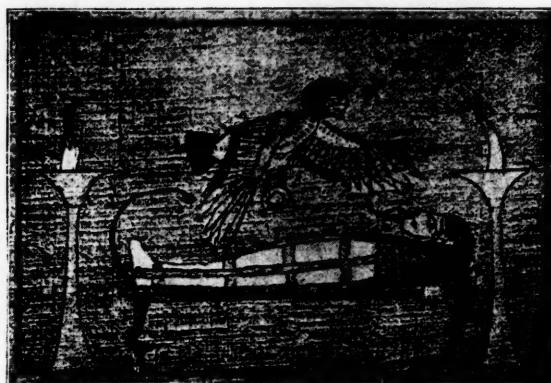
² In Hebrew *תְּוִזְבַּח*, "likeness" or "image," translated by the Septuagint *εἰκὼν*. The passage in Gen. i. 26 means that Adam was shaped in the *ka* of Elohim.

³ The symbol of the *ka* is two arms bent at right angles with hands stretched upwards. See Erman, *Life in Ancient Egypt*, English edition, p. 307.

⁴ *Religion and Conscience in Ancient Egypt*, pp. 33-35.

sycomore, and pouring out blessings on the kneeling *ka* and the bowing *ba* bird. The sustenance of the parts of the dead was attributed to the beneficent tree spirit, and hence the widespread veneration of the sycomore in every home, and more particularly about Memphis with its vast cemetery of Sakkara, where the great sycomore of the south was a noted feature.

"The focus of domestic worship then appears to have been a niche or false door in the wall of the principal hall, usually in the west wall like the false doors of tombs; this was dignified with steps in some cases, and painted with the objects of adoration, the ancestral double and spirit, *ka* and *ba*, and the tree-genius who preserved them."



THE BA VISITING THE BODY.¹

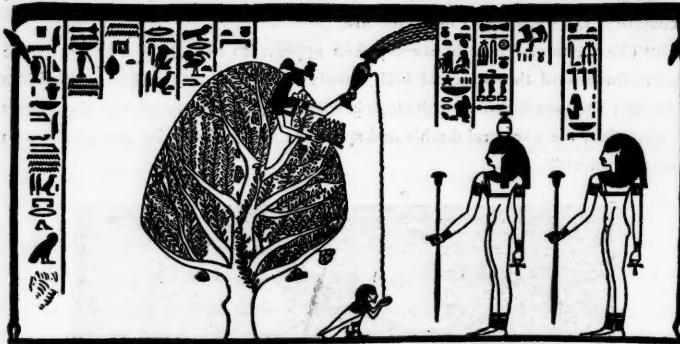
Professor Petrie adds :

"It seems that a tree with its thick hiding foliage and deep shade was thought to be a particularly suitable abode for both human and divine spirits; and 'the sycomore of the south' is called the living body of Hathor."

Without attempting to criticise Professor Petrie's explanation, we venture to suggest that the tree was probably worshipped in prehistoric times for the shelter which it gave and the fruits which it offered. If the soul after death could not find a tree, it was supposed to be without protection and sustenance, and so the spirit of the tree was invoked to grant an asylum to the homeless spirits of the deceased.

¹ From the Ani papyrus.

Our illustration which is reproduced from Lenormant's *Histoire de l'Orient*, Vol. III., p. 202, represents the *ba* under a persea tree gratefully accepting the drink of life from the Nut goddess



NUT FEEDING THE BA WITH WATERS OF LIFE FROM HEAVEN.
ISIS AND NEPHTHYS WITNESS THE SCENE.

of heaven residing in a tree spirit. Two goddesses carrying a flower-crowned staff in their right hand and the key of life in their left, witness the scene.



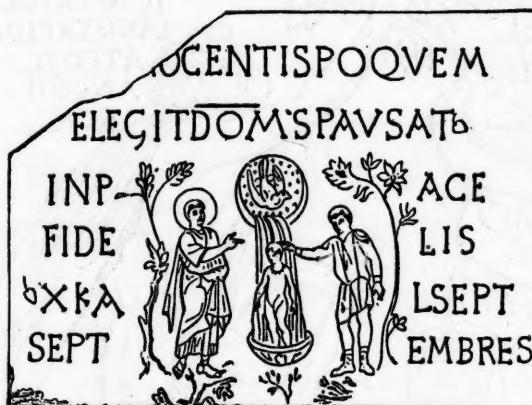
THE CORONATION BAPTISM OF KING RAMESSES III. (Lübke's *Gesch. d. Plastik*, p. 39.)¹

That the idea of the water of life was not limited to the conception of drinking it, but also of bathing in it, can be proved by an ancient Egyptian bas-relief which represents the baptism of King Rameses III. by the gods Thoth and Horus, the former representing the Egyptian Logos-deity, the latter, god the son, the child of Osiris and Isis, the avenger and the resurrected sun-god. There can be no doubt about the significance of

¹ The author is indebted to J. L. Corning of Munich, formerly American consul, for all the illustrations marked with a star. They have been reproduced from hand drawn copies, being part of his valuable MS. collection of pictures illustrating the kinship of religious myths.

the liquid which these deities pour out upon the sun-adorned head of the king, for it is represented by streams of Egyptian crosses (†), the so-called keys of life.

This baptism with the water of life remained an important part of the coronation ceremony of Egyptian kings down to Roman times, for even the emperors, as Augustus and others, are represented in the monuments as receiving this baptism with the water of life at the hands of the Egyptian gods.



BAPTISM OF CHRIST WITH WATERS FROM HEAVEN.

Tombstone of Aquileja.¹

The most modern form of the water of life is the myth of the fountain of youth which during the age of the discovery of America was supposed to be in Florida.

Stories travel, especially religious stories ; and so we may assume that the idea of the golden apples of Idun which we find in Northern mythology is the same story as the legend of Genesis indicated by the idea of the tree of life. We read in the Edda that enemies of the gods had stolen Idun's immortality-giving apples, and the task devolved upon Thor to bring them back to Asgard ;

¹ Reproduced from F. X. Kraus, *Geschichte der christlichen Kunst*, Vol. I., p. 164.

for the gods began to grow old, and would have suffered death unless they regained the food upon which their immortality depended.

The story of Hercules and the golden apples of the Hesperides is the Greek version of the legend of the tree of life, and it is by



HERCULES PLUCKING THE APPLE.*¹

no means accidental that Greek pictures of Hercules in the garden of the Hesperides remind us vividly of the story of Adam and Eve in Eden.

¹ Relief on a marble tablet at Benevento. The serpent is wound about the trunk living, and one of the Hesperides lies sleeping beneath. Copied from Doniis's *Inscriptiones Antiquae*, Tab. VII., n. 2.

We must call attention to the fact that there are two kinds of trees—life-giving and death-giving trees. The tree of life is mentioned only twice in Genesis: when Adam had eaten of the tree of knowledge of good and evil, God said: “Behold, Adam has become as one of us, knowing good and evil; and now lest he put forth his hand and take also of the *tree of life* and eat and live forever, therefore Yahveh-Elohim sent him forth from the Garden of Eden to till the ground from whence he was taken.” (Genesis, Chap. iii., 22, 23.)

When Proserpine, the goddess of spring, was carried off by Pluto, the god of death, Venus offered her a pomegranate to eat,



HERCULES IN THE GARDEN OF THE HESPERIDES.

An antique vase-picture representing the poisoning of the serpent and the delivery of the fruit on a branch.*¹

and so made Proserpine subject to the king of death. That was a fruit from the tree of death, and Venus, the goddess of love, offered it to Proserpine. Pomegranates play an important part in the Eleusinian mysteries.

Similar stories of life-sustaining and death-imparting apples, or other fruits, occur in many other myths, in the stories of Hercules, in the German fairy tales,² and also in the folklore of savages in various parts of the earth.

¹ From Gerhard's *Äk. Abh.*, Tabel XX., fig. 1.

² The wicked step-mother tries to kill little Snowwhite (*Schneewittchen*) with a poisoned apple.

The Book of Genesis does not mention what kind of fruit the tree of life bears. In Assyrian sculptures it has the appearance of a pine cone, except that it is very large; it might be a pineapple were it not on a tree. In European folklore the fruit is commonly called an apple, and Christian art always represents the tree of the knowledge of good and evil as an apple-tree. We cannot doubt that the idea, which, so far as we know, was first pronounced by St. Augustine, is derived from Greek mythology, the apple being the symbol of Venus.

Biblical interpreters have never failed to point out the connexion between the tree of the knowledge of good and evil and sexual-



HERCULES PLUCKS THE
FRUIT OF THE TREE, THE
SERPENT HANGING LIFE-
LESS ON THE TRUNK.
(Antique gem.)



A MEDAL OF EMPEROR
ANTONINE.*
Copied from Millin's *Gallerie
Mythologique*, fig. 445.

ity. Adam and Eve were unconscious of good and evil before they ate of the fruit, and knew that they were naked after having partaken of it. Both Gnostic and Christian writers regard the whole story as an allegory in which the fall of man was identified with sensual pollution. And thus the idea originated that immortality could be regained only by perfect abstinence, or virginity. This is plainly expressed in Christian and Gnostic scriptures. In the gospel of the Egyptians, we read that immortality depends upon the perfect restoration of innocence. Jesus answers Salome's question, "How long shall Death reign?" by saying: "As long as ye women give birth, for I came to make an end to the works of

woman." Similar ideas reverberate through the canonical New Testament, and can be traced through the literature of the early Christians.

The connexion of death with birth is as natural as it is true. The Buddhists speak of all compounds as being subject to dissolution, and thus everything that is born is doomed to die. A beginning necessitates an end and only that which is without a beginning can be without end.



PICTURE ON AN ANCIENT GEM.*¹
From Spence's *Polymetis*.



THE TREE OF LIFE AND THE SERPENT
ON AN ANTIQUE CAMEO.
(From Montfaucon.)*²

¹ Mr. J. L. Corning quotes Higgins, who says in his *Anacalypsis*: "Here is the serpent called Heva tempting Adam. Spence calls it a drawing of Hercules, after he has killed the serpent; but why is the serpent up in the tree, instead of lying dead on the ground? Where are the club, the lion's head and feet? The serpent is evidently whispering in Adam's ear, while he is taking an apple. Parkhurst has given a passage from Clemens which proves that the Greek Bacchanals were well acquainted with the myths of Eve."

² We owe this picture as all the other illustrations of the tree in the garden of Hesperides to Mr. J. L. Corning. It has been reproduced by Montfaucon who says of it: "It was preserved for several centuries in one of the most ancient churches of France, and passed for an image of terrestrial paradise to represent the fall of Adam." The inscription which Montfaucon regards as being modern and in Hebrew is, according to Higgins, an allusion of the biblical myth and should read: "The woman saw that the tree was good for food, and that it was pleasant to the eyes, and a tree to be desired to make one wise." (See his *Anacalypsis* I.

But the comfort of all primitive religions is not so much the attainment of eternity as of regeneration. The wish for immortality therefore leads to the conception of resurrection.

Dionysus, the emancipator, the liberator, the saviour, is the life and happiness-bringing god of Greece. He rescues Kora, which is but another name for Proserpine, the life-spending vegetation, the daughter of Demeter, the personification of the earth, from the power of death, and celebrates with the rescued goddess his marriage feast.



HERCULES IN THE GARDEN OF THE
HESPERIDES.

Picture on an antique water urn.



AN ANCIENT PAGAN SCULPTURE.

Reproduced in Montfaucon's first volume of *L'Antiquité Expliquée*.*¹

pp. 272-273). But all this is mere guesswork. The inscription is illegible in the reproduction and is probably not less unintelligible in the original cameo. It seems to us very doubtful whether it is Hebrew, and may be, for all we know, an example of Ephesian letters. We would add that the cameo, if genuinely antique, indicates a version of the myth which cannot be traced in the Greek poetry now extant. The man is not Hercules, but Zeus, as indicated by the thunder bolt. The female figure is probably one of the Hesperides but may be Minerva, or Juno, or Aphrodite, or even Proserpine. The animal which jumps up at the trunk of the tree is obviously intended to play a significant part, for the attitude of the woman indicates that she intends to stoop toward it. The part which the five animals play that appear underneath the main design is doubtful; they do not help in the explanation, but make the intention of the whole composition still more obscure.

¹ This picture does not represent Hercules in the traditional costume with club and lion's fur, which goes far in proving that it does not represent the garden of the Hesperides but some kindred subject. But for the absence of the golden fleece it might be Jason and Medea.

The symbol of the Dionysian cult is the wine which on account of its exhilarating effect is regarded as the water of life. The god makes his appearance in a triumphal procession with shouts of *ειο!* riding on a donkey. The thyrsus of the Bacchic revellers carries on its top a cone, the same fruit in the very same form that appears as the fruit on the tree of life on Assyrian illustrations.

There is no saviour among the Greeks the events of whose life are not somehow connected with the acquisition of the fruits of the



HEBE OFFERING HERCULES THE CUP OF IMMORTALITY.*

A vase painting copied from Inghirami's *Monumenti Etrusche*, Tab. XXXVI.

tree of life and the drink of immortality. Thus Hercules, the national hero of Greece, is reported to have gone to the garden of the Hesperides and plucked the life-giving apples from the tree guarded by a serpent. But there is this difference, that according to the Greek version Hercules deceives the serpent, while in the Biblical account the serpent deceives Adam.

Judging from the illustrations preserved on vases and bas-reliefs, the traditions of the myth, such as we know them through

Greek authors, must be greatly mutilated and corrupted. Many incidental features of these illustrations remain unexplained, and it is quite possible that if we knew all the obliterated features of the legend, we could better define its relation to, and trace its connexion with, the ancient Assyrian story of the tree of life.

The legend of the tree of life is closely related to an ancient Oriental ritual which was a partaking of the food of life, partly in commemoration of the dead, partly as a sacrament celebrated for the purpose of acquiring the mysterious power of a resurrection.

The Chaldean story of the origin of death has been discovered in the tables of Tell-el-Amarna, and in the Library of Asurbanipal, in Nineveh, a fragment of the story being in the possession of Professor Scheil, who published an article on the subject under the title, "A Page of the Sources of Berosus."¹

According to the tables of Tell-el-Amarna, as reported by Gunkel,² Adapa had done some wrong to the storm bird representing the south wind, and was cited before the tribunal of Anu, the God of Heaven. Ea advises him how to gain the favor of the two gods that serve as gate-keepers of heaven. As soon as they had ushered him into the presence of Anu, some food of death would be offered him which he should not eat; water would be handed him which he should not drink; a garment would be given him which, however, he should don; oil would be offered him, with which he should anoint himself. When Adapa came to heaven everything happened as Ea had told him, with the exception that Anu at the intercession of Tammuz and another deity took pity on Adapa. So Anu did not offer him food of death and water of death, but food of life and water of life; which, however, following the behest of Ea, Adapa refuses, and thus foregoes the boon of eternal life.

Adapa is a Babylonian Adam; he is called "The Seed of Mankind," and his characteristic feature is "wisdom," perhaps in the same sense that modern zoölogists speak of the species *homo sa-*

¹ *Recueil de Travaux relatifs à la Philologie et l'Archéologie Egyptiennes et Assyriennes*. Vol. XX., 1898. "Une page de Bérose."

² Gunkel, *Schöpfung und Chaos*, p. 420 et seq. Comp. p. 148, footnote 3, and p. 151.

piens. Adapa is apparently, as Professor Zimmern, of Leipsic, suggests, the Alaparos of Berossus, the confusion of the Greek Α and Δ being easily explained by the similarity of their forms.

A literal translation¹ of the Adapa myth reads as follows:²

[Several lines at the beginning are missing.]

" . . . The Southwind (blew and dipped him under water), into the mansion (of his master) he immersed him :

" 'O, Southwind, (thou hast) done me harm ! Thy wing I shall break !'

" As soon as he had spoken thus with his mouth, the wings of the Southwind were broken. Seven days the Southwind no longer blew over the earth.

" Anu spoke to his messenger Ilabrat : 'Why does the Southwind since seven days no longer blow over the earth ?'

" His messenger Ilabrat answered him : 'My Lord ! Adapa, the son of Ea, has broken the wings of the Southwind.'

" When Anu heard this word he cried out : 'Help !' He sat down on his throne . . .

[Here is missing, Ea's advice given to Adapa.]

" . . . Ea . . . Heaven . . . he requested to bring him a dress of mourning

" . . . he put it on.

" . . . [to Anu] the King now must go.

" [When thou ascendest] to the [Heaven and when thou approachest the throne of Anu], at the throne of Anu there will be [Tammuz and GIS.ZI.DA].

" They will see thee and ask thee : 'For whose sake do you look like that, Adapa, for whom do you wear a dress of mourning ?'

" [Thou must reply] : 'Two gods have disappeared from our earth ; therefore I do so.'

" [They will ask thee] : 'Who are the two gods who from the earth have disappeared ?'

" [Thou must reply] : 'Tammuz and GIS.ZI.DA.'

" Then they will look at one another and wail, but then a good word to Anu they will speak, and will make that Anu will look kindly on you.

¹ Translated from E. T. Harper's German translation of the stone tablets in Hermann Gunkel's *Schöpfung und Chaos*, p. 240 ff. We omit the division of lines, which are as much as possible preserved by the German translator as they are in the stone tablet. The original is not always metrical, yet in some places unmistakably betrays rhythm. The tablets were written at the request of King Amenhotep or his mother, an Assyrian princess, the Queen Dowager Tye, for the purpose of imparting religious information, and it is probable that the copyist made slight changes in the Assyrian poem for the purpose of rendering the sense of the myth more intelligible to the Egyptian reader.

² *Beiträge zur Assyriologie*, II., p. 420 ff. See also Zimmern, *S. S. Times*, Philadelphia, June 18, 1892.

"When thou appearest before Anu, one will offer to thee food of death. Eat not of it! Water of death they will offer thee. Drink not of it! A garment they will offer thee. That, however, don! Oil they will offer thee: anoint thyself with it! The counsel which I give to thee do not despise, the word which I have spoken to you hold fast.

"Then the messenger came to Anu [saying]: 'Adapa [is here who] has broken the Southwind's wing.'

"[Anu replied]: 'Let him appear before me.'

"... of the sky he made lie down, to the sky he ascended. When he arrived in heaven he approached the throne of Anu. There were standing at the throne of Anu, Tammuz and GIS.ZI.DA. When they beheld Adapa they cried out, 'Help!' [adding]: 'Sir! For whose sake dost thou look like that, Adapa, for whom dost thou wear a garment of mourning?'

"[He replied]: 'From the earth two gods have disappeared, therefore I wear a garment of mourning.'

"[They asked]: 'Who are the two gods who have disappeared from the earth?'

"[He replied]: 'Tammuz and GIS.ZI.DA.'

"Then they looked at one another and wailed.

"When thereupon Adapa turned to Anu the king, and when Anu beheld him he said to him: 'O, Adapa! why hast thou broken the wings of the Southwind?'

"Adapa answered to Anu: 'My Lord! For the house of my master I caught in the midst of the ocean fishes. The sea was as smooth as a mirror. Then the Southwind blew and dipped me under. Into the house of my lord he immersed me. In the wrath of my heart...'

"[Tammuz] and GIS.ZI.DA spoke a good word (for him) to Anu; then his wrathful heart was assuaged.

"[He said]: 'Why did Ea allow an impure man to see of the heaven and of the earth the most inner secrets, made him great, and bestowed a name on him? But we, what can we endow him with? Food of Life fetch for him, that he may eat!'

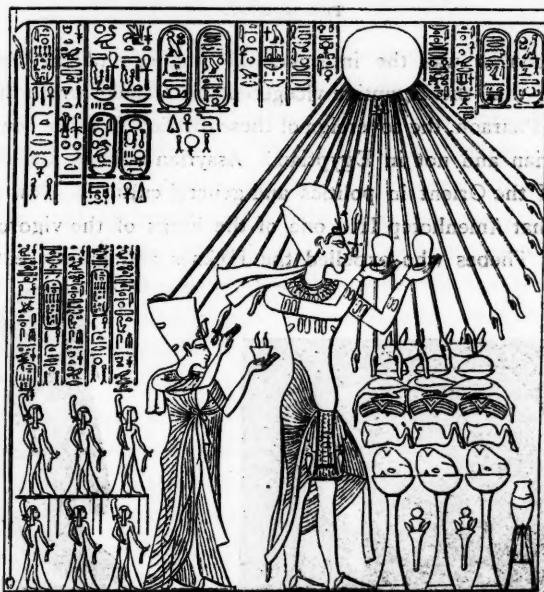
"Food of Life they fetched for him, but he did not eat. Water of Life they fetched for him, but he did not drink. A garment they fetched for him, he put it on. Oil they fetched for him, that he might anoint himself.

"Then Anu looked at him and wailed over him: 'O, Adapa, why didst thou not eat, why not drink? Thus thou shalt not have (eternal) life....'

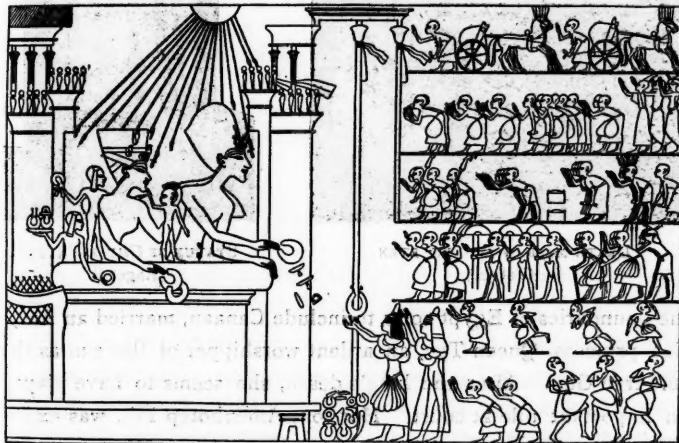
"[Adapa said]: 'Ea, my Lord, has commanded me: Eat not, drink not!'

"... he returned to his country." [The concluding lines are broken off.]

The discovery of Assyrian stone tablets in Egypt was quite a surprise and seemed at first sight very strange; but the mystery has been solved, and we know now that in the second millennium



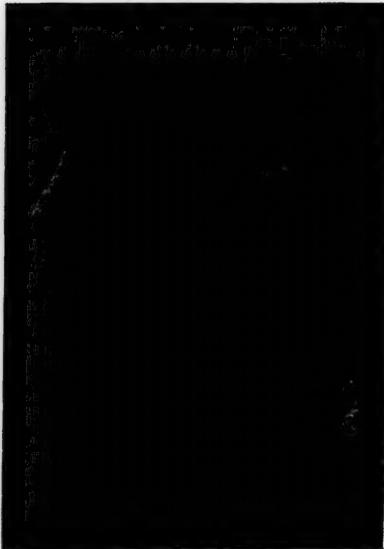
KING CHU-EN-ETEN; HIS CONSORT THE QUEEN, AND HIS SIX DAUGHTERS
MAKING SACRIFICIAL OFFERINGS TO THE SUN.



KING CHU-EN-ETEN PROTECTED BY THE SUN-GOD, REPRESENTED AS MAKING THE
PEOPLE OF EGYPT PROSPEROUS. From the Monuments of Tell-el-Amarna.¹

¹ Meyer, *Gesch. Aeg.*, cf. Springer, *Handb. Alterth.*, p. 26.

B. C. Assyrian was the international language of the East, so much so that the Egyptian vicegerents of Canaan wrote their reports to Pharaoh, the sovereign of these districts in those centuries, in Assyrian and not in Egyptian! Assyrian was the official language of the Orient in politics and general culture. Now it happened that Amenhotep III., one of the kings of the vigorous dynasty of Thebes who expelled the Hyksos and greatly extended



DEATH-MASK OF CHU-EN-'ETEN.
(Petrie.)



STATUE OF CHU-EN-'ETEN.
(Raget.)¹

the boundaries of Egypt so as to include Canaan, married an Assyrian princess, Queen Tye, an ardent worshipper of the sun as the sole true God. After the king's death, she seems to have played an important rôle at court. Her son, Amenhotep IV., was exclu-

¹ We here reproduce the cast and statue of King Chu-en'-eten in evidence of the faithfulness with which he is portrayed in the monuments. The small chin seems to indicate a weakness of character and may account for the failure of his far seeing, perhaps too far-sighted, monotheistic reform.

sively under her control. Obviously at the suggestion of the queen dowager he changed his name to Chu-en'-eten, which means "splendor of the solar disk," and built a new capital near the modern town of Tell-el-Amarna. The religious reformation of King Chu-en'-eten was not a lasting success. The people still clung too tenaciously to their traditional polytheism and did not take kindly to the foreign monotheistic sun-worship. Three successors of Chu-en'-eten, S'aanacht, his son-in-law, the priest 'Ey, one of his intimate friends, and third in order Tuet'anchamun, a convert to the new faith, were succeeded in about 1320 B. C. by the powerful Har-em-heb, the leader of the discontented, the reactionary polytheistic party, whose counter-reformation wiped out every trace of the monotheistic Assyrian sun-worship.

Judging from statues and bas-reliefs, Chu-en'-eten was of a sickly disposition and of a weak character. Had he been less fanatical and more circumspect, he might have reconciled the powerful Egyptian clergy; but lacking the necessary discretion he finally failed through the general discontent created by his innovations. Prof. Adolf Erman in his *Life in Early Egypt* says (Engl. tr., p. 46-47):

"We shall always lament the sad end to Chu-en'-eten's reformation; for though it was a good thing for the country that the state of disorder should cease, yet this victory of the old orthodox party sealed the fate of the Egyptian religion, —no one again attempted a reformation, and the religious conceptions of the nation were narrowed."

So much in explanation of the discovery of Assyrian stone tablets in Tell-el-Amarna.

The legend of the food of life and the food of death is the story of Tammuz, the Lord or Adon of the Asiatics and the Adonis of the Greek. It is the God who dies and whose death is lamented but who is resurrected again under great rejoicing. The prophet Ezekiel complains about the Jewish women who took part in the Tammuz festival (ix. 14), and we know of Astarte, the Queen of Heaven, that she was worshipped with offerings of cakes and of drink. The prophet Jeremiah rebuked the Egyptian Jews for their idolatry, but they answered him:

"Then all the men which knew that their wives had burned incense unto other gods, and all the women that stood by, a great multitude, even all the people that dwelt in the land of Egypt, in Pathros, answered Jeremiah, saying.

"As for the word that thou hast spoken unto us in the name of the Lord, we will not hearken unto thee.

"But we will certainly do whatsoever thing goeth forth out of our own mouth, to burn incense unto the queen of heaven, and to pour out drink offerings unto her, as we have done, we, and our fathers, our kings, and our princes, in the cities of Judah, and in the streets of Jerusalem: for then had we plenty of victuals, and were well, and saw no evil.

"But since we left off to burn incense to the queen of heaven, and to pour out drink offerings unto her, we have wanted all things, and have been consumed by the sword and by the famine."

Sacramental eating was connected with almost all Oriental religions and the rite symbolised the attainment of life immortal. It is perhaps no accident that the Israelites who, though living among nations that believed in immortality, pass the doctrine over in the sacred writings with silence, express an aversion for sacramental food-offerings as idolatrous.

The story in Genesis is apparently mutilated. In the Chaldean report we have a tree of life and a tree of death; food of life and food of death; water of life and water of death. This contrast is lost sight of in Genesis, and the strange thing is that according to Genesis the forbidden tree which is spoken of as the Tree of the Knowledge of Good and Evil, proves to be the tree of death, while in the myth of the Tables of Tell-el-Amarna it is the food of death which Adapa is warned against, and the food of life that is offered him; and he foregoes the boon of immortality because he refuses to eat of it.

SACRAMENTAL EATING AND CANNIBALISM.

In the Homeric age the Greek offered libations to the gods, and the form in which they sanctified the cup reminds one strongly of the Christian sacrament. When old Priam proposed to ask the slayer of Hector for the body of his beloved son, he prayed to Zeus with the sacramental cup in hand, the scene being thus described by Homer (*Il.*, XXIV., p. 305-309):

"When he had sprinkled with water, his wife a chalice him handed.
 There in the courtyard standing he prayed; and looking to heaven
 Took he the wine and, uplifting his voice, spoke loudly as follows:
 'Zeus, our father, thou ruler of Ida, supremest and greatest,
 Oh, let Achilles receive me to-day with compassion and mercy!'"¹

The Romans had an ancient custom of celebrating love-feasts, called *charistia*, to which none but kin and relations were invited. If some quarrel had arisen between relatives, it could more easily be adjusted when the sanctity of the table and the merriment of the company made every one better inclined to mutual good-will.²

We need not assume that the Roman *charistia* originated under Assyrian, or Persian, or Egyptian influence; we are perfectly justified in regarding the custom as indigenous, for it seems to date back to the early days of the republic. The bread for daily use was regarded with a pious awe, as it is still in many parts of Europe. Bread represents life, and it is not a senseless ornament when we found the loaves of ancient Rome marked with a cross,³ the symbol of life.

The celebration of the Tibetan ceremony for obtaining "immortality" has been called by the missionary Huc "the Buddhist Eucharist" on account of its resemblance to the Christian sacrament. The ceremony is of great interest; as it is not much known, we quote a report of it from Mr. L. A. Waddell's *Lamaism*, pp. 444-448:

¹ Translated in the meter of the original, which reads as follows:

Νιγάμενος δὲ κόπτελλον ἐδέξατο ἡς ἀλόχουο.
 εἰχετ' ἐπειρα στὰς μέωφ ἔρκει, λειβῆ δὲ οινον
 οὐρανὸν εἰσανιδὸν, καὶ φωνῆσας ἔπος ηδά·
 Ζεῦ πάτερ, Ἰδηθεν μεδών, κιδώστε, μέγιστε,
 δός μ' ἐς Ἀχιλλῆσ φίλον ἐλθεῖν ἥδ' ἐλεεινόν.

² "Convivium etiam solemne majores (Romanorum) instituerunt idque *charistia* appellaverunt, cui praeter cognatos et affines nemo interponebatur, ut siquid inter necessarios querela esset orta, apud sacra mensae et inter hilaritatem animorum fautoribus concordiae adhibitis tolleretur." *Val. Max.*, II., 1, 8.

³ The cross, or rather the figure of two intersecting lines, was a salutary sign, but it was not called a "cross" until after the reign of Constantine crucifixion had been abolished.

"This sacrament is celebrated with much pomp at stated periods, on a lucky day, about once a week in the larger temples, and attracts numerous votaries. Crowds throng to the temple to receive the coveted blessing. Its benefits are more particularly sought in cases of actual illness, and when death seems imminent; but every village must have it performed at least once a year for the life of the general

community, and after its performance any prolongation of life is credited to this service; while a fatal result is attributed to the excessive misdeeds of the individual in his last life or in previous births.

"The chief god addressed is Buddha *Amitayus* or *Aparamita*, 'The god of infinite Life,' or 'The Eternal.' Unlike the Chinese Buddhists, the Lamas never confuse *Amitabha* (the Buddha of infinite Light) with his reflex *Amitayus*; they represent these differently, and credit them with different functions. The other gods specially identified with life-giving powers are 'The five long-Life Sisters,' mountain nymphs presiding over the everlasting snows, and to a less degree the white Tārā, and Ushpisharāni; and even *Yama*, the Lord of Death himself, may occasionally be propitiated into delaying the day of death.

THE BUDDHIST EUCHARIST.
Reproduced from Waddell's *Buddhism of Tibet*.

"The priest who conducts this ceremony for propitiation of *Amitayus* and the other gods of longevity must be of the purest morals, and usually a total abstainer from meat and wine. He must have fasted during the greater part of the twenty-four hours preceding the rite, have repeated the *mantras* of the life-giving gods many times, 100,000 times if possible, and he must have secured ceremonial purity by bathing. The rite also entails a lot of other tasks for the prepa-



ration of the consecrated pills and the arrangement of utensils, etc., and extends over two or three days.

"The arrangements are as follows:

"Upon an altar, under the brocaded dragon-canopy, within the temple or in a tent outside, are placed the following articles:

- "1. *Las-bum*, the ordinary altar water-vase.
- "2. *Ti-bum*, the vase with pendent mirror and containing water tinged with saffron.
- "3. *d Ban-bum*, the 'empowering vase' with the chaplet of the Five Jinas.
- "4. *Ts'e-bum*, the 'vase of Life,' special to *Amitayus*, with a banner of peacock's feathers and sacred Kusa-grass.
- "5. *Ts'e-ch'an*, or the 'wine of Life,' consisting of beer in a skull-bowl.
- "6. *Ts'e-ri'l*, or the 'pills of Life,' made of flour, sugar, and butter.
- "7. *Chi-mar*, or wafers of flour and butter and rice.
- "8. *mDah-dar*, or sacred divining-dagger with silk tassels.
- "9. *rdor-jehi gsun t'ag*, or the divining-bolt, a *vajra* or thunderbolt-sceptre with eight ridges to which a string is attached.

"In the preliminary worship the pills are made from buttered dough, and the ambrosia or *amrita* (Tib., *dud-tsi* or 'devil's juice') is brewed from spirit or beer, and offered in a skull-bowl to the great image of Buddha *Amitayus*. Everything being ready and the congregation assembled, the priest, ceremonially pure by the ascetic rites above noted, and dressed as in the frontispiece, abstracts from the great image of Buddha *Amitayus* part of the divine essence of that deity by placing the *vajra* of his *rdor-jehi gsun-t'ag* upon the nectar-vase which the image of *Amitayus* holds in his lap, and applying the other end to his own bosom, over his heart. Thus, through the string, as by a telegraph wire, passes the divine spirit, and the Lāma must mentally conceive that his heart is in actual union with that of the god *Amitayus*, and that, for the time being, he is himself that god. Then he invokes his tutelary-fiend, and through him the fearful horse-necked *Hayagriva* (Tamdin), the king of the demons. The Lāma, with this divine triad (namely, the Buddha and the two demon kings) incorporate in him, and exhibiting the forms of all three to spiritual eyes, now dispenses his divine favors. He takes up the *Las-bum*-vase and consecrates its contents, saying:

"'Om! namo Tathagata Abhi-khita samayasirī hum! Nama candra vajra krodha Amrita hum phat!'

"Then he sprinkles some of the water on the rice-offerings (*gtor-ma*) to the evil spirits, saying, 'I have purified it with *svabhava*, and converted it into an ocean of nectar within a precious *Bbum*-bowl. Om akaromu-kham! Sarva dharma nantyanutpanna tatto! Om! A! Hum! phat! Svaha! I now desire to bestow the deepest life-power on these people before me; therefore, I beg you demons to accept this cake-offering, and depart without doing further injury.'

"Here the Lāma, assuming the threatening aspect of the demon-kings, who

are, for the time being, in his body, adds: 'Should you refuse to go; then I, who am the most powerful *Hayagriva* and the king of the angry demons, will crush you—body, speech and mind—to dust! Obey my mandate and begone, each to his abode, otherwise you shall suffer. *Om sumbhanī*,' etc. Now, the Lāmas and the people, believing that all the evil spirits have been driven away by the demon-king himself, shout, 'The gods have won! the devils are defeated!'

"The Lāma then proceeds to secure for himself the benedictory power of life-conferring. He first meditates on 'the guardian-deities,' murmuring thus: 'The upper part (of the divine abode) is of thunderbolt tents and hangings; the lower part of earth-foundation and adamantine-seat; and the walls are of thunderbolts. The entire building is a great tent, protected by precious charms, so that the evil spirits can neither destroy it, nor can they gain entry. *Om! vajra rakhya rakhya sutra tikhtha vajrave svaha!*'

"Then the magic-circle (*mandala*) is offered up, saying:

"'If I fail to refer to the successive Lāma-saints, my words and deeds will count for nothing. Therefore must I praise the holy Lāmas to secure their blessing towards the realisation of my plans. O holy *Padma-sambhava*, in you are concentrated all the blessings of the present, past, and future! You are the Buddha of the great final Perfection (*Maha-utpanna*) who beheld the face of Lord *Amitayus*. O saint possessed of the gift of undying life, of life lasting till the worlds of re-births are emptied! You hid away from us, in the snowy regions, the revelation upon the true essence of the five hundred 'Obtainings of Life.' The one which we now perform is 'the iron palace of the attainment of life' (*Ts'e-grub l'ags-kyi-pho-bran*), and is extracted from *d Kon-mch'og-spyi-dus*. It was discovered by the saint *'Dsah-Ts'on-snin-po* in the cave where you hid it; and this mode of endowering a person with life has come down to me through many generations of saints. Now, O Lord *Amitayus* and the host of radiant gods! I beg you to sustain the animal beings, vast as the starry host, who now, with great reverence and praise, approach you. *Om a hum!* O holy shrine of our refuge! *Hri!* O Hosts of the Bright World of Light! *Pad-ma t'od-phren-rtsal-vajrasa-mayaja siddhi phala hum!*'

"Then here is repeated '*Ts'e-gug*,' or 'The Invoking of Life,' thus:

"'O Lord *Amitayus*, residing in the five shrines whence glittering rays shoot forth! O! *Gandharva* in the east! *Yama* in the south! *Naga raja* in the west! *Yaksha* in the north! *Brahma* and *Indra* in the upper regions! and *Nanda* and *Taksha* in the lower regions! And especially all the Buddhas and Bodhisatwas! I beg you all to bless me and to gratify my wishes by giving me the gift of undying life and by softening all the injuries of the harmful spirits. I entreat you to grant life and implore you to cause it to come to me. *Hri!* I beg your blessings, O Buddhas of the three times. (*Dipankara*, *Sākyā Muni*, and *Maitreya*.)'

"At this stage the celestial Buddhas, Bodhisats, and other gods are now supposed to have consecrated the fluid in the vase and transformed it into immortal

ambrosia. Therefore the priest intones the following chant to the music of cymbals: 'This Vase is filled with the immortal ambrosia which the Five celestial Classes have blessed with the best Life. May life be permanent as adamant, victorious as the king's banner. May it be strong like the eagle (*Gyun-drun*) and last forever. May I be favored with the gift of undying life, and all my wishes be realized.'

"*Buddha! Vajra! Padma! Karma, Kapalamala. Hri maharinisaayu siddhi phala hum! Om A Hum vajra Guru Padma siddhi ayukke Hum nija!*"

"The priest now bestows his blessing as the incarnate *Amitayus* as well as the other gods of longevity, by laying-on of hands, and he distributes the consecrated water and food to the assembled multitude. When the crowd is great the votaries file past the holy *Läma*. In smaller congregations the *Läma*, with the *Ti-bum* vase in hand, walks along the rows of kneeling worshippers near the temple door, and pours a few drops of the holy fluid into the hands of each votary. With the first few drops the worshipper rinses his mouth, and with the next few drops he anoints the crown of his head, and the third few drops are reverently swallowed.

"Then the *Läma* brings the vase of Life and places it for an instant on the bowed head of each of the kneeling votaries, reciting the spell of *Amitayus* (*Om Amarani jivantiye svaha*), which all repeat. Then the *Läma* touches the head of each one with the power-conferring vase; and afterwards, in similar manner, with the divining-dagger, saying: 'The life which you now have obtained is unfailing like the *vajra*-armour. Receive it with reverence! As the *vajra* is unchangeable, so now is your life. *Vajra rakhya rakhya svaha!* Worship *Amitayus*, the god of boundless Life, the chief of all world-rulers! May his glory come, with virtue and all happiness.' And all the people shout, 'Glory and all-happiness!'

"Each worshipper now receives from the skull-bowl a drop of the sacred wine which he piously swallows; and each also receives three of the holy pills, the plateful of which had been consecrated by the touch of the *Läma*. These pills must be swallowed on the spot. They are represented as beads upon the vase which the image of the god of Infinite Life holds in his lap.

"The *Läma* then takes a seat on a low throne, and the votaries file past him offering him a scarf and any money presents they may have to make; the majority pay in grain, which is piled up outside the door of the temple. Each then receives a benediction from the *Läma*, who places his hand on their heads and repeats the spell of *Amitayus*; and on its conclusion he throws over their shoulder a knotted white scarf (*Tsim-tu*) from a heap of consecrated scarves lying at his side. The colors of the scarves are white for the laity and red for the priests."

It is possible, we may even say probable, that the idea of food of life (be it as the fruit of the tree of life, or as a drink of life, or

as meat, or cakes, or bread of life) found expression at an early and prehistoric age in some religious ritual, for we know that the Indians as well as the Iranians celebrated sacraments which indicate the prevalence of such a conception of food. The soma and butter offerings of the Aryas in India and the Myazda sacrifice of Zarathustra remind us strongly of the use of the Hoddentin among the Apaches.

Captain John Bourke has collected interesting facts on the use of the Hoddentin among the Indians which show its close analogy to the Christian sacrament of the Lord's supper. He says in the "Medicine-men of the Apache"¹:

"One of the first things to be noticed among the Apache, in this connexion, was the very general appearance of little bags of buckskin, sometimes ornamented, sometimes plain, which were ordinarily attached to the belts of the warriors, and of which they seemed to be especially careful.

"The bags spoken of revealed when opened a quantity of yellow colored flour or powder, resembling cornmeal, to which the Apache gave the name of 'hoddentin,' or 'hadntin,' the meaning of which word is 'the powder or pollen of the tule,' a variety of the cat-tail rush, growing in all the little ponds and ciénegas of the Southwest.

"In dances for the benefit of the sick the medicine-men in the intervals between chants applied this yellow powder to the forehead of the patient, then in form of a cross upon his breast, then in a circle around his couch, then upon the heads of the chanters and of sympathising friends, and lastly upon their own heads and into their own mouths.

"No Apache would, if it could be avoided, go on the warpath without a bag of this precious powder somewhere upon his person, generally, as I have said, attached to his ammunition belt. Whenever one was wounded, hurt, or taken sick while on a scout, the medicine-man of the party would walk in front of the horse or mule ridden by the patient and scatter at intervals little pinches of hoddentin, that his path might be made easier. As was said to me: 'When we Apache go on the warpath, hunt, or plant, we always throw a pinch of hoddentin to the sun, saying "with the favor of the sun, or permission of the sun, I am going out to fight, hunt, or plant," as the case may be, "and I want the sun to help me."

"Upon attaining the age of puberty, girls fast one whole day, pray, and throw hoddentin to the sun.'

"When an Apache dies, if a medicine-man be near, hoddentin is sprinkled upon the corpse. The Apache is buried in the clefts of rocks, but the Apache-

¹ *Annual Report of the Bureau of Ethnology, 1887-1888*, pp. 499 ff.

Mohave is cremated. 'Before lighting the fire the medicine-men of the Apache-Mohave put hoddentin on the dead person's breast in the form of a cross, on the forehead, shoulders, and scattered a little about.'

"Hoddentin seems to be used to strengthen all solemn compacts and to bind faith.

"The myths of the Apache relate that Assanut-li-je spilled hoddentin over the surface of the sky to make the Milky Way."

Captain Bourke proves by a great number of quotations that analogous rites existed among many other nations, Negroes, the ancient Indians, Egyptians, and Europeans, and that on account of the conservatism in religious affairs the tendency prevails to retain for sacrificial meals some prehistoric food such as manna, unleavened bread, or wafers. Sacred breads and cakes are known all over Europe and the custom of eating them on special festive occasions dates back (as Grimm points out in his *Teutonic Mythology*, Vol. I., p. 63) to prehistoric times. The Mexicans celebrated "the festival of the wafer, or cake," in honor of Huitzilopochtli. Bancroft says:

"They made a cake of the meal of bledos which is called 'tzoalli,' which was afterward divided in a sort of communion."—*Native Races*, Vol. III., p. 323.

Concerning the prevalence of the notion of the healing power of prehistoric food among other nations than the Indians Captain Bourke quotes an instance from the ancient Japanese fairy tales, in one of which a hare flayed by a crocodile is given the following advice:

"Go quickly now to the river mouth, wash thy body with fresh water, then take the pollen of the sedges and spread it about, and roll about upon it; whereupon thy body will certainly be restored to its original state."

Our sketch of the sacred food of life would be incomplete, did we not mention the cannibalistic ceremonies of those savages who partake of the flesh and blood of a human sacrifice; and it is strange, though perhaps natural, that these terrible rites, wherever performed in honor of a deity of vegetation, that is to say, the nourishing power of nature, are frequently connected with the idea that the god himself must be partaken of as food. Such customs still prevailed in Central America when the Spaniards conquered

Mexico and seem to have been all but common at an early stage in the evolution of mankind. We quote one instance only which is typical of many others. Prof. T. G. Müller says¹:

"The main sacrifice of Tezcatlipoca was the youngest and most beautiful prisoner of war or slave, whose duty it was to represent the god in his youthfulness. He was worshipped the whole year as a god. Twenty days before the festival he was married to four beautiful girls, and five days before the festival the most opulent feast was given him. On the day of the ceremony, he accompanied the image of the god which headed the procession, and was then sacrificed in a temple especially built for the purpose, with all due reverence, about a mile outside of the city, beyond the lake. The heart cut out from his breast was presented to the image, and then to the sun; but the body was not, as is the case with other sacrifices, thrown down over the steps of the temple, but carried down by the priests. Noblemen and priests received the arms and legs of the sacrifice as a sacrificial meal. The youths devoted to his worship performed a dance to the god, and the virgins offered honey cakes called 'holy flesh,' which was destined as a prize to the victors in the races which took place on the temple stairs."—P. 617.

The custom of sacrificing and eating a God-incarnation is not limited to the indigenous peoples of the New World but can be traced among the Negroes as well as among the primitive inhabitants of Asia, and there the practice was continued down to the age of the Chaldaean civilisation. Thus Berosus tells us that "during the five days of the festival called the Sacæa, a prisoner condemned to death was dressed in the king's robes, seated on the king's throne, allowed to eat, drink, and order whatever he chose, and even permitted to sleep with the king's concubines. But at the end of five days he was stripped of his royal insignia, scourged and crucified."²

This Babylonian rite is apparently, as Mr. Fraser suggests, a further evolution of a more ancient custom that is still practised among the savage tribes of Africa, according to which the king, who is believed to be the incarnation of the deity, usually of life, or of the sun or heaven, is sacrificed in his best years and before his physical powers can give out. Mr. Fraser says:

¹ *Geschichte der Amerikanischen Urreligionen.*

² See J. G. Fraser, *The Golden Bough*.

"We must not forget that the king is slain in his character of a god, his death, and resurrection, as the only means of perpetuating the divine life unimpaired, being deemed necessary for the salvation of his people and the world."

With the advance of civilisation the old custom was modified.

Mr. Fraser says :

"When the time drew near for the king to be put to death, he abdicated for a few days, during which a temporary king reigned and suffered in his stead. At first the temporary king may have been an innocent person, possibly a member of the king's own family; but with the growth of civilisation, the sacrifice of an innocent person would be revolting to the public sentiment, and accordingly a condemned criminal would be invested with the brief and fatal sovereignty."

Some ceremonies of Tibetan Buddhism indicate that the Tibetans celebrated in prehistoric times cannibalistic love feasts which had a religious significance. We quote the following condensed report from an article on "Death and Resurrection"¹:

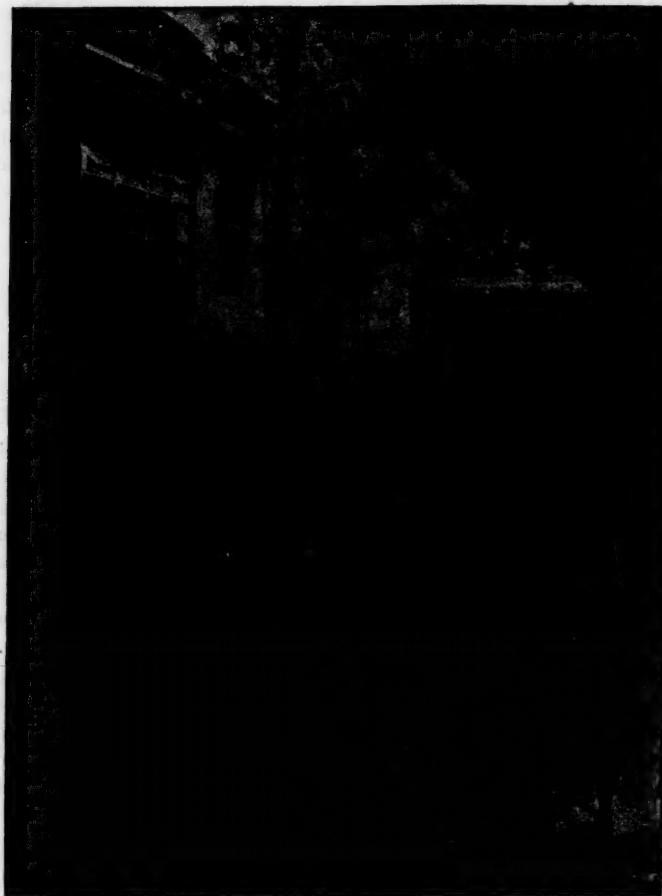
"Very strange performances are the death-dances of the Tibetan mystery-plays, one of which is performed on the last three days of the year and is called 'the ceremony of the sacrificial body of the dead year.' The effigy of a man made out of dough as life-like as possible and having inside a distinct heart and all the entrails filled with a red fluid, is placed by four cemetery ghouls in sight of the numerous spectators in the centre of the yard, and at once bands of skeleton-ghosts rush upon the corpse to attack it. This is the time to display the necromantic power of Lamaism over the evil spirits. Monks and lamas come forth and go through a series of ceremonies, the magic effect of which keeps the fiends away. But a more formidable devil with great horns and possessed of superior powers makes his appearance and takes the field. Whereupon a saint or an incarnation of Buddha himself comes to the rescue, sprays flour on the enemy, makes mystic signs and utters incantations. The skeleton-ghosts and the big fiend grovel before him and implore mercy. He graciously yields to their supplications and allows them to partake of a sacramental meal. While they kneel before him he gives to each one of them a little flour to eat and a drink out of a vessel of holy water."

"This concludes the day's performance.

"The corpse, however, is not destined to be preserved. On the next day the fight is renewed, and after a cannonade with blessed mustard-seed and other exorcisms, an awful demon appears whose title is 'the holy king of religion.' He wears the head of a bull, a dagger in the right and the effigy of a human heart in the left hand. This strange figure seems to represent the main deity of the ancient Tibetans, when they were still in the habit of offering human sacrifices, not in effigy

¹ Published in *The Open Court*, Vol. XI., pp. 496-498.

but in reality. The demon god has been converted by Buddha and become a protector of Buddhism. He is now satisfied with human sacrifices in effigy, and the



DANCE OF THE DEATH-DEMONS IN HEMIS MONASTERY.¹
Preparatory to the sacrificial eating of the effigy of a man representing
the dead year.

man made of dough, being supposed to be an enemy of Tibet, is surrendered to him. He dances round the figure of the man on the ground, stabs him, binds his

¹ Reproduced from E. F. Knight's *Where Three Empires Meet*, London, 1893.

feet in a snare, and at last cuts off his limbs, slits open his breast, takes out his bleeding heart, lungs, and other intestines. At this moment a horde of monsters falls upon the remnants of the dismembered dough man and scatters them in all directions. The pieces are collected again in a silver basin and the Holy King of Religion, eating a morsel, throws them up in the air. This is the signal for the *finale*: the pieces are caught and fought for by the demons, and at last the crowd of spectators joins the general scramble for pieces of dough, representing human flesh, which they either eat or treasure up as talismans.

"Similar ceremonies are executed by different sects in different ways, but all of them indicate survivals of practices which antedate the institutions of Buddhism."

Prof. W. M. Flinders Petrie, the learned Egyptiologist, has repeatedly called attention to the ancient customs of god-eating and of religious cannibalism. The killing of the deity which in civilised times was done in the shape of its representative animal, was an essential part of the ancient worship. The statue of Amen was covered with the slaughtered ram's skin and "the actual remains of the bulls found in the Serapeum by Mariette show that in the nineteenth dynasty they were consumed by the worshippers."¹

We have unequivocal evidence that in the earliest times of Egypt parts of the bodies of the dead were eaten by their children which was apparently done as an act of piety for the sake of preserving the souls of the deceased in the surviving generation. An explanation of this strange custom is given by Professor Petrie in an exceedingly interesting article entitled "Eaten With Honor."² And since it is impossible to surpass this prominent scholar either in the presentation of facts or his exquisite humor, we make the following extensive quotations:

"Prejudice is strange. I suppose the average British house-keeper would rather travel in the same carriage with a gambler, or a rake, than with a cannibal; the former two she might call 'gentlemanly,' but her skirts would be gathered closer around her when she brushed past the latter. It is not by any means only the horror of presupposed murder; but, without that being in question, it is the use of human flesh as food which to modern respectability seems ghastly. There is no code of Mrs. Grundy about it, because it is outside of the very limited expe-

¹ *Religion and Conscience in Ancient Egypt*, p. 37.

² Published in the *Contemporary Review*, June, 1897, pp. 819 ff.

riences of that worthy lady. No, it is sheer mental prejudice against strangeness, which puts even the innocent and affectionate cannibal below the moral offender. Yet a large part of mankind are cannibals, and still more—perhaps all—have been so, including our own forefathers, for Jerome describes the Atticotti, a British tribe, as preferring human flesh to that of cattle.

"Does the intuitionist object to the principle? Yet he agrees that intuition varies from land to land and age to age; that each people are only responsible for acting up to the code of their own time. And the successors of the Stoicks should be the last to live on hollow prejudices.

"Does the utilitarian object? Yet one main purpose of the custom is utility; in its best and innocent forms it certainly gives the greatest happiness to the greatest number. And the successor of the Epicureans should be the last to object to the mental and physical pleasures of preventing corruption by eating good meat.

"When, a short time ago, it came to light that a civilised people, at about 3000 B.C., who had exquisite handicrafts, whose children played with choiceily wrought toys, while their fathers carried on a wide-spread trade in the Mediterranean—when it appeared that these people habitually cut the heads from their dead and ate some portion of the bodies, no one would credit the notion. Every sort of explanation was started; but the facts could not be gainsaid, and the broken marrow-bones and piles of ribs and vertebrae told plainly how the Libyan invaders of Egypt had honored their beloved dead.

"And now this year it is found that one of the grandest and most capable people that ever lived—those who built the splendid masonry of the Pyramids, at once the greatest and most highly finished works of man; who carved some of the most lifelike statues, who organised society and labor on a great scale, who treasured a delicate moral feeling—that many of these people reverently buried the bones of their dead after elaborately removing all the flesh. Why they did so we can hardly doubt when we look at the ways of other races.

"When we classify the motives of cannibalism that are recorded, we find that in more than half the races mental motives prevail, and in rather less than half the physical motives of hunger or pleasure. We may roughly classify the motives thus:

	PER CENT.
Honor, kindness, future good, love.	20
To obtain strength or magic results	19
As a ceremony, or to acquire position.	10
As a punishment	5
	54
From hunger or need of food.	18
From preference as food	28
	46

The higher motives of honor and kindness prevail mostly in Asia, Australia, and South America, but seem to be unknown in Polynesia, North America, and Africa. The Thibetans considered it a glorious burial for their honored elders to be eaten;

some Australians also eat the dead with the greatest and most solemn honor; and the Tupi and Capanahuas in South America did likewise. Besides this, it is often a matter of kindness and love for the dead. The Cucumas of South America said that 'it was better to be inside a friend than to be swallowed up by the cold earth.' And who will say that they are wrong? Such seems to have been the main sentiment in that quarter of the world, as it appears again among the Botocudos, Tapuyas, Mayoruna, Mundrucu, and Guyanis. The idea of protecting the dead from decay and putrefaction, which would befall them in the ground, and giving them a kindly and affectionate disposal among their friends and kin, is as far removed as possible from any brutality or baseness. In Central Australia the Yulugundis have a still more touching feeling; when lovers are parted by death, the survivor ensures that they shall be united, in death if not in life, by consuming part of the dead. In Asia also we find the Samoyeds and Ostyaks saying that the elders will have a better future if eaten; and a tribe of the Gonds near the source of the Nerbuddah eat those who are fatally ill or aged as 'an act of kindness.' And in ancient times 'the Massagetae and Derbices thought it a most miserable end to die of sickness, and killed their parents, relatives, and friends who had grown old, and ate them, preferring to do this themselves rather than leave it to worms,' as Jerome tells us. It is thus evident that there is a widely-spread sense of protecting the beloved dead from the chilling loneliness and corruption of the grave by thus dividing the body among the survivors. We are so apt to think that delicacy of feeling must be unknown among those who differ much from ourselves, that we always underrate the motives of lower races. Often we may find a far higher and deeper sympathy shown by them than in anything to which we are accustomed. . . .

"Other motives, for the benefit of the living, are also usual. The idea that eating the heart of a lion will make a man brave, or the legs of a deer will make him swift, is a common one in many parts of the world. And thus, by the same process of analogy, the Queenslanders will eat a great warrior who has died, to obtain his valor, or a dead baby in order to get its youth, the old people thus seeking rejuvenation. Among many other Australians this analogy is also powerful. In North America the Tlinkets thus consume the bravest who have fallen, and in the south the Yamas suck out the marrow from the bones in order to acquire the soul. Many other tribes in both America and Africa eat the flesh from reasons vaguely described as religious or superstitious. Certainly they expect to acquire some power and virtue by the custom. . . .

"Lastly, the eating is a matter of hatred, as a punishment to criminals, among the Tatars, the Aghora in India, the Battaks of Borneo, and other peoples; this is probably to prevent the dead returning to be avenged on the living; as the Greenlanders say that a slain man can avenge himself on his murderer by rushing into him, which can only be prevented by eating a piece of his liver. . . .

"Thus we see that, quite apart from the use of human flesh simply as food, in the majority of tribes the mental desires are prevalent, to honor or benefit the

dead, to obtain their virtues, to acquire ceremonial position, or, lastly, to prevent their haunting the survivors.

"The great moral objection to cannibalism is, no doubt, that it may lead to murder; and this is the special blot on African cannibalism. . . ."

"Primitive man was omnivorous in all probability, and had no objection to eating flesh of any kind. Such at least is Dr. Steinmetz's conclusion. . . ."¹

The drinking of the blood of human victims, who were sacrificed on special occasions and may originally have represented the deity itself, was an ancient institution which was still practised now and then in historical times. Herodotus (III., 4-11), speaking of the conquest of Egypt by the Persians, tells us of Phanes of Halicarnassus how he betrayed the country to Cambyses and concludes his report with a description of a terrible blood covenant which the Greek mercenaries of the Egyptian king celebrated:

"Then they brought on the sons of Phanes, one after the other, and killing them let their blood run into the mixing bowl, which done they poured wine and water to it, and when all their allies had drunk of the blood they began the battle."²

Sallust also tells us that Catilina and his band practised a similar bloody rite when they took the oath not to betray the secrets of their conspiracy.³

Human flesh and blood being used for sacramental purposes in the interest of preserving life, naturally came to be thought of by the superstitious as the most effective remedy against fatal diseases.

Even in the days of Tertullian the religious rite of drinking blood and eating human flesh, not in a symbolical sense as prac-

¹ "Endokanibalismus" in *Mittb. der Anthrof. Gesellsch.* Wien, XXVI., 1.

² "Μετὰ δὲ ἐγνέοντες κατ' ἑναστον τὸν παιδὸν (τοῦ Φάνεω) ἔσφαζον ἐξ τὸν κρητῆρα, διὰ πάντων δὲ διεξελθόντες τὸν παιδὸν οινόν τε καὶ θύρον ἐσεφόρεον ἐξ αὐτὸν, ἐμπιόντες δὲ τοῦ αἵματος πάντες οἱ ἐπικούρου οὐτοῦ δὲ σύβαλον."

³ Sallust speaks of it as a rumor, but the mere rumor proves that such ideas which are survivals of pristine savage beliefs still haunted the minds of the people in the times of Julius Caesar. The passage reads as follows:

"Fuere qui dicent, Catilinam oratione habita, quum ad jusjurandum populares sceleris sui adigeret, humani corporis sanguinem vino permixtum in pateris circumtulisse; inde quum post execrationem omnes degustavissent, sicuti in solemnibus sacris fieri consuevit, aperuisse consilium suum atque eo dicticare fecisse, quo inter se fidi magis forent, alias alii tanti facinoris consciit." Sallust. Catil. 22.

ticed in the Christian sacrament, but literally and actually, was still haunting the minds of the people. Tertullian, addressing in his *Apologeticus* the Pagans, enumerates several instances of Pagan practices and exonerates the Christians of the false accusation of slaughtering and eating an infant at their communion. Tertullian says (*Ap.*, § 9):

"As to meals of blood and such tragic dishes, read—I am not sure where it is told (it is in Herodotus, I think)—how blood taken from the arms, and tasted by both parties, has been the treaty bond among some nations. I am not sure what it was that was tasted in the time of Catiline. They say, too, that among some Scythian tribes the dead are eaten by their friends. But I am going far from home. At this day, among ourselves, blood consecrated to Bellona, blood drawn from a punctured thigh and then partaken of, seals initiation into the rites of that goddess. Those, too, who at the gladiator shows, for the cure of epilepsy, quaff with greedy thirst the blood of criminals slain in the arena, as it flows fresh from the wound, and then rush off—to whom do they belong? those, also, who make meals on the flesh of wild beasts at the place of combat—who have keen appetites for bear and stag? That bear in the struggle was bedewed with the blood of the man whom it lacerated: that stag rolled itself in the gladiator's gore. The entrails of the very bears, loaded with as yet undigested human viscera, are in great request. And you have men rifting up man-fed flesh? If you partake of food like this, how do your repasts differ from those you accuse us Christians of?"

EDITOR.

[TO BE CONCLUDED.]

CRITICISMS AND DISCUSSIONS.

THE BIBLE.

To the Editor of The Monist.

DEAR SIR:—I have received and read your article on the Bible. I am obliged to you for sending it to me, as it states so fully your views on the subject. I find that they are totally divergent from mine; in fact the chasm between us is so wide that I cannot attempt to bridge it. We disagree entirely on the most fundamental truths; and there is no common ground left from which to undertake the discussion of the case. I can say nothing that you have not already considered and deliberately rejected. Arguments which to my mind are clear and convincing have no weight with you, because you approach the subject with different prepossessions, and your primary principles are such as to exclude your acceptance of anything offered from my point of view. I must, therefore, respectfully decline your kind tender of the columns of *The Monist* for a communication from me on the subject.

Your philosophy is unintelligible to me. Your conception of God as an unconscious, impersonal (or as you prefer to say "superpersonal," whatever that may mean) norm moving and directing the universe in all its parts, instead of being the last result of scientific inquiry, is to my mind incapable of explaining anything. I cannot thus account for the existence of the universe or any of its multitudinous organic structures, or any of its endless adaptations, nor for animal life and especially that of man with its numberless manifestations. With my modes of thought I necessarily postulate a personal God infinite in his being and attributes, whose wisdom and power are displayed in his works, who has contrived and made all, and who guides and directs all to the accomplishment of His own glorious purposes. I then have no difficulty in conceiving that He may be pleased to reveal Himself to His intelligent creature man, and even after his alienation from his Maker by wilful transgression to institute measures for his recovery. And with this view I can understand how He might condescend to enter into intimate relations with one of the families of mankind to make it a nucleus from which influences may emanate over the rest of mankind. And I can imagine that in the act of establishing this relation in the first instance He, whose crowning work of grace is seen in the incarnation, might temporarily assume a human form and seal His covenant with Abraham.

in a manner accordant with the usages of men, yet with a dignity which filled Abraham with awe as is shown in his humble but urgent and persevering petition on behalf of guilty Sodom. And I can see nothing derogatory in His arresting Moses on His way to Egypt by some means not particularly explained in the brief narrative—perhaps by a stroke of dangerous illness, the cause of which he understood—for no personal appearance of the Lord is spoken of; Moses was on his way to assume the leadership of Israel, and yet had neglected to have his son circumcised, which in that period, when worship was so largely symbolical, was the significant rite of initiation to membership in the people of God, the neglect of which was punishable with exclusion from the people. It was inadmissible that the leader and legislator of Israel should himself disregard one of its fundamental laws.

I can further conceive that in the early stages of religion, when it had not yet gained a firm foothold even among the chosen race themselves, and was in danger of being stifled by surrounding idolatry, measures of severity might be employed to put down and to eliminate corrupting influences, which are not permissible when it has gained more strength and can maintain itself in the midst of adverse surroundings. The Lord, who is the arbiter of life and death, who can devastate whole regions by earthquake and pestilence, by fire and flood, and none can question the righteousness of His dealings, even when we cannot understand their meaning, is competent to judge of crises occurring in a different age of the world, and in a totally different state of society, as we cannot in our imperfect knowledge of the situation. Men may execute a divine sentence, and so far forth be approved, and yet do it in a very improper way. The faults of good men, and especially of bad men recorded in the Bible, cast no discredit upon the Bible itself or its author.

Inspiration does not make the subjects of it omniscient; it guards them from error in declaring what is revealed to them. Paul knew by divine revelation that the Lord Jesus was to come again and that the dead were then to rise. But when that event would take place, he did not know, and did not pretend to say. The Lord Jesus tells us that this was known to God alone; and that he himself in his human nature did not know when it would take place. That the Apostle Paul should think that it might take place in his own life-time is not surprising. It might for all that he knew. And that the Lord Jesus might blend the destruction of Jerusalem with the great event in the end of the world which it prefigured is of the same nature with the appearance of the sun rising over the mountain tops which seem to be in contact with it. Our Lord's own words prevent us from imagining that he intended to reveal the time of his second coming, which he distinctly declares that in his human nature he did not know. The destruction of Jerusalem with its aggravating horrors took place in the lifetime of that generation which he was addressing. This was the pledge that gave assurance of all the rest. All was virtually accomplished when that pledge was fulfilled to the letter.

I know that all this means nothing to you. I have not said it with any expectation of convincing you. It is all waived aside by the philosophical principles with which you set out. I have merely wished to justify myself from my own point of view, and to show that I can consistently believe that the Bible is the revealed word of God, and as such is of untold importance to every living man.

W. HENRY GREEN.

The Pines, Caldwell, Lake George, N. Y., Sept. 18, '99.

* * *

[This letter, which is a terse delineation of the old orthodox position, written by the most representative thinker of the Presbyterian Church in this country, sums up the traditional conception of the doctrine of inspiration in such a lucid and forcible form, and is at the same time pervaded by such a firm spirit of conviction, as to merit the consideration of all who wish to weigh both sides of the problem. It was written as a private communication, but the editor asked for and received permission to publish it in the columns of *The Monist* as a reply to the editorial article of the October number. Professor Green, however, wishes it distinctly understood that it does not contain the full argument which can be made for his attitude in the momentous question at issue. He does not undertake in these lines either to defend his own, or to refute the opposing, views of others, but is satisfied with a simple statement of his position.]

POTENTIAL THINGS.

In *The Monist* for January 1892, Dr. Paul Carus the Editor discusses the subject: "Are There Things In Themselves?" In the course of his arguments he refers to "potential existence and latent qualities," which he says "are fertile and useful ideas but we must beware not to employ them incorrectly."

But the fact is he has himself employed the term potential incorrectly, or in a manner that is misleading; and this has suggested the following criticism, and given rise to the remarks made and the arguments advanced on the subject of "Potential Things."

DEFECTIVE LOGIC.

The Doctor says: "We might express ourselves to the effect that the egg contains the potential existence of feathers, but with the same logic we might say the egg contains a potential chicken broth."

The defect in this statement consists in the misuse of the word potential. This word has definite meaning, as unmistakable as any word in the English language. But as here used it is wrested from its true and primary meaning and is employed in its secondary and broad sense which is ambiguous. It is here used as a synonym to and in the place of the word possible.

We correctly say the egg contains a *possible* chicken broth, when we refer to the fact that the egg contains the power of transforming and growing into a chicken, which may then be made into a broth. This is a possibility, i. e., it is possible that a chicken broth is the outcome of the egg. But the word potential cannot be used correctly in this connection.

In like manner when the Doctor says: the egg contains the potential existence of feathers, he refers to the possible outcome of the egg; to its being changed, possibly, into a chick, on which feathers will then grow and exist. He does not refer to the fact that the potency to grow the feathers on the chick is contained in the egg from which it was hatched. This is the real point at issue. Are there potential things? Does the egg which is changed into a chick contain potential feathers?

Now the word potential relates to potency and not to substance; to the formative force, not to the thing being formed. Things in a potential state consist in certain combinations of forces capable, under proper conditions, to give definite forms to substances. And "according to the law of transformation and equivalence of energy" the human mind is forced to conclude that, every thing that appears in the transformed and actual state of a thing must have had its equivalent in the former, or potential, state from which it was transformed. Therefore, as the chick is but the transformed state of the egg the conclusion that the feathers on the chick had their corresponding equivalence in the forces of the organic constitution of the egg, cannot be avoided. The mind persists in asserting that the power, at the proper stage in the orderly process of transformation and growth, to change certain constituents of the blood of the chick into feathers *inheres* in the egg, since it is a self-evident fact. We therefore make good, sound logic, as well as state a fact in nature when we say: the feathers of the chick are potentially contained in the egg, which is equivalent to saying: the egg contains potential feathers. But when we now apply this logic to the other case and say: A chicken broth is potentially contained in the egg, we shall, by analysis, see the fallacy.

NO POWER IN THE EGG TO MAKE A BROTH.

In the first case we find that the power to form and produce feathers on the chick is, in a latent condition, inherent in the egg. This power is not added to the chick from without after it developed from the egg, but it is a quality inherent in the constitution of the egg. But in the other case we find no inherent power to make the chicken into a broth. A broth can be made of a chicken, but the efficiency to make it is not contained in the chicken much less in the egg from which it is hatched. The chicken is a specialised substance which may be made into a particular broth, but the power to make the broth resides in the mind and will of the cook. We might say, the broth is potentially in the cook's brain after he has conceived the idea and concluded to make it; and that the chicken is substantially the broth—it being the substance of which the broth is made. For it is an axiom that a thing cannot potentially contain *that* which it has not the inherent power to

produce. Therefore, since the skill and power required to make a broth are not contained in the egg, nor in the chicken, but in the ingenious mind of man, it follows conclusively that the egg does not contain a potential chicken broth. But in the first case, it being a fact that the *possibility* of producing the feathers is contained in the egg and the *efficiency* in the full-fledged chick, *but in no outside agent*, —that all the glorious knowledge and inventive genius of mankind cannot produce them, it follows conclusively that the feathers are potentially in the egg. Hence the logical difference between the two statements.

IRON ORE NOT A POTENTIAL SWORD.

The same defective logic is contained in the Doctor's statement: "Any heap of iron ore can be called a potential sword." Here again the ambiguous, misleading word potential is employed in the place of the simple and plain word possible. All that can be truthfully said of iron ore relative to its becoming a sword is, that it is substance or material of which swords can be made. We can correctly say of a sword that it was substantially contained in the iron ore, but when we say it was potentially contained therein, we speak falsely.

The iron in the ore has the inherent quality, under proper treatment, to change into steel, but it has not the skill of forming itself in swords; that resides in another agent. And since it is the peculiar form of a piece of steel that makes it a sword, and the power to give it that form we find is contained in the mind of man we can therefore truly say: the sword is potentially in the skilful mind of man, but not in the iron ore. To bring out this point still clearer and more forceful we give the following illustration.

THE COLLECTED MATERIAL FOR A HOUSE NOT A POTENTIAL HOUSE.

Mr. Thrifty resolves to build a house. He employs an architect, prepares his plan and gets his drafts. He makes a contract with a builder for the construction of the house. He buys all the materials needed, from the foundation to the finish, and has them conveyed to the place where the house is to be erected. Now we cannot correctly call these collected materials a potential house. Though they comprise all the material needed for the house, and though they are intended to be constructed into a house, yet they are not a potential-house. For it is an axiom that, *For a thing to be a potential something else it must contain the power in itself, as a quality of its own nature, to become or produce that something else.*

Thus a tadpole is a potential frog, because it, and it alone, possesses the power of developing and producing a real frog.

But on the other hand, a heap of stones is not a potential wall, because it does not possess the power, as a quality of its own nature, to form or construct itself into a wall. It is the material of which a wall may be built,—a possible wall—and we may say that a heap of stone is substantially, or in substance, a wall, but when we say it is a potential wall, our statement is absolutely false. Likewise, the collected

material for Mr. Thrifty's house is substantially, or in substance, the house, but it is not a potential house.

Neither should we say that the house is potentially in the mind of the architect. Here we find it ideally. The architect, in his imagination or image-forming faculty, has the power to conceive and form an ideal house in his mind, i. e., *think* a house, and has the skill to transfer it from his mind to paper as a design; but in so doing he does not reduce his ideal house to the real—the materially constructed, finished house. The power to build the house is not contained in the architect's imagination, but in the mind and brain of the skilled mechanics. The mason has the idea of a wall impressed on his mind, and has acquired the skill and power of dressing stones and constructing them into walls. Likewise the carpenter has acquired the skill to do the wood-work; the roofer to make the roof, and the plasterer to plaster the walls etc., and when the painter and the wall-decorator finally appear to give the finishing touch to the house, this is not adding something to the house, —as the Doctor declares that the growing feathers on a chick is adding something to the chick—for the painting and wall-decorating were understood and included—were contained in the contract made by Mr. Thrifty with the builders, in like manner as the power of growing feathers on the chick was included in the persistent forces immanent in the egg.

Thus we observe four aspects of the one object—the house ideally in the mind of the architect; the house potentially in the mind of the skilled mechanics; the house substantially in the solid material of which it is constructed; and the complete, finished house. And these four aspects are present in everything produced or objectised by man: (1) The ideal conception; (2) the mechanical skill and power; (3) the substance or solid material in which to formally express and fix the conceived ideal; (4) the concrete finished object.

MORE LOOSE STATEMENTS.

Says the Doctor:

"We may say that the hen's egg contains a potential chick; but this is a mere mode of speech devised to say that the egg can be changed into a chick under certain conditions.

"There is no chick at all contained in the egg, and nothing that is like a chick. The chick is something different in kind from the egg. The unity of the egg-cell organism in the yolk is radically different from the unity of the full-fledged chick."

Now we ask are these things so, or are they mere assertions based on surface observations? Taking up the last statement we inquire: Is the unity of the egg-cell organism radically different from the unity of the full-fledged chick? The word *radically* is here used in its broad sense. Primarily it relates to radix or root, and in this sense it follows logically that, for a thing to be radically different from another thing the two must necessarily rise or grow from different roots or primaries. But is such the case here? Are the organic forces that produce the egg-cell organ-

ism and hold it in its unity not the same persistent forces that subsequently organise the chick and hold it in its full-fledged unity? Botany teaches that the plant is epitomised in its leaves. Now in this case, is the unity of the leaf radically different from the unity of the plant? Is it not a fact, that the unity of the leaf is a miniature expression of the unity of the plant? In the case of the chick the unity of its parents was epitomised in the egg and how can there be a radical difference between the unity of their several organic forms? Is the unity of the rays of light in the focal point different from that in the more diffused rays where they pass through the focalising lens? No; the unity of the concentrated forces in the egg-cell organism is not destroyed in the process of transformation of the contents of the egg, but is kept inviolate and is now expressed in the chick. The persistent organic forces of the egg-cell have simply diffused themselves in the chick and thereby extended their scope of action.

THE EGG THE SAME IN KIND AS THE CHICK.

The Doctor says: "The chick is something different in kind from the egg." Yes on their surface, in their physical expression, but not in their essential, or organic nature. The chick contains no organic forces that are different in their nature from those contained in the egg from which it was hatched. The difference cannot be in kind; it is merely in degree of physical expression. The nature of the persistent forces inherent in the egg-cell remains unchanged and continuous throughout the vital process from conception to dissolution. The chick is but the reincarnated expression—through the medium of the egg—of the persistent forces of its parents. In detail these several expressions may vary but not in organic constitution. Concentration (the egg) and diffusion—the organised structure arising from the egg; formation and transformation is the observed order of Nature.

The "formation of the chicken soul" is not "a new formation," as the Doctor says, in the sense that something has been "breathed" into it from without, or has been superadded to it, that is different in its nature from that which was primarily contained in the egg. It is merely the higher outgrowth of the inherent forces of the egg-cell, as the flowers and fruit on a tree are the higher out-growth of the inherent organic forces—the latent qualities of the tree. And in this case it is clear that, though the tree existed for years, bringing forth leaves and forming wood etc. but no flowers and fruit appeared, yet the power to produce the latter, at the proper stage of growth, was contained in the seed from which the tree grew. There is no power added to the tree from without to produce this higher or highest growth, but the tree preceding this one, on which the seed was formed, had such power. This was transmitted to the seed and now manifests itself on the succeeding tree as it had done on the preceding one. Just so with the chick. The parent birds that produced the egg had the quality of forming "the chicken-soul,"—as the Doctor expresses it,—and this was transmitted to the egg-cell, and at the proper stage of growth manifests itself in the chick as it had manifested itself in its parents. This

quality of soul-formation, is not "breathed" into the chick from without, by some extraneous soul force, but is inherent in the constitution of the egg-cell. The organic forces in the egg are the same in kind as those in the chick and in its parents.

SOMETHING LIKE A CHICK IN THE EGG.

That there is no organised, material chick in the unhatched fertilised egg is a fact; but to say that the egg contains "nothing that is like a chick," is an unwarranted assertion.

The adage is "like begets like," but if nothing is contained in a hen's egg that is like a chick, it is evident that nothing that is like a chick could come out of it.

We might say that a serpent's egg contains nothing that is like a chick; which is a fact. And for that very reason it cannot be changed into a chick. But inasmuch as the hen's egg, in its organic constitution, contains the inherited nature and qualities of the parent birds that produced it, it follows naturally and conclusively that it contains something that is chicken-like; and the proof of it is, it manifests the power of transforming the egg into an actual chick. In what the likeness consists, this is not now demonstrable, neither is it the point at issue.

THE HEN'S EGG CONTAINS A POTENTIAL CHICK.

To say "the hen's egg contains a potential chick," the Doctor asserts, "is a mere mode of speech devised to say that the egg can be changed into a chick under certain conditions." Here he would lead the reader from the true use of the word potential. The fact that a piece of cloth can be formed into a coat does not make the cloth a potential coat. It is in substance the coat, but the skill of making a coat is not contained in the cloth, it cannot form itself into a coat. It lacks this the necessary inherency which constitutes one thing a potential something else. In the case before us, however, the power of changing the egg into a chick is inherent in the organic constitution of the egg, and it is this *inherency* that constitutes it a potential chick.

Again, when we say the silk-worm is a potential moth or imago we state a fact, for the efficiency of changing into a moth is a quality of the nature of the silk-worm itself. But when we say the leaves which the silk-worm eats and converts into silk, *they* are potential silk, then we speak falsely. The leaves are in substance the silk, but the power of changing them into silk is inherent in the silk-worm, and therefore the silk is potentially in the worm.

Now, when we view an egg in the light of modern science we find it composed of two distinct realms or fields of activity in the process of its being transformed into a chick: namely, a formative field and a nutritive field. The former is positive or active, the latter is passive and reactive. The former is the field of nuclear substance in which the organising potency resides; the latter is the field of somatic or body plasma, the substance or material which is to be constructed into the physical body of the chick. According to Professor Weismann, the nuclear field is the

realm of real life, and the "body or soma is a subsidiary appendage," a "deciduous growth which arises round about the real links of life."

Thus in the realm of real life the chick is potential, and in the subsidiary realm or body life it becomes phenomenal or active, and these two realms are included in the constitution of the egg. In the nuclear substance or realm of real life the chick is in some way perfectly formed. This may seem inconceivable, yet it remains a fact. Preformation, in some way or other, demands our recognition. And it is in perfect agreement with the logic of the expression: The egg contains a potential chick.

When we predicate of a thing that it *contains* something, we have *two* distinct ideas in our mind. As when we say the bottle contains wine. Here the bottle is one idea, and wine is the other idea. Just so when we say the egg contains a potential chick. Here, however, we do not refer to the egg-shell and its contents, as in the case of the bottle and its contents—the wine. No; here the concrete egg with its body plasma and nutritive potency constitute one idea; and the formative potency and organising efficiency—that *unity* of organic forces which is capable of transforming the contents of the egg into a chick, inherent in the nuclear substance of the egg-cell in the yolk, constitute the other idea. The concrete egg contains an abstract and unknown quantity. And when we reduce this supersensuous, unknown quantity to a physical expression—not by any rules of mathematics but by gentle heat in an incubator or under a hen—we find it equals a chick. Hence the unknown quantity inherent in the egg being equal to a chick, our conclusion that the hen's egg contains a potential chick is correct.

DANIEL BRIGHT.

PHILADELPHIA, Pa.

EDITORIAL REPLY.

Criticism is always welcome, and since Mr. Daniel Bright has discovered "defective logic" in an article of mine entitled "Are there things in themselves?" I take pleasure in publishing his arguments and will answer them as briefly as the complicated problem will permit.

In the article referred to I deny the existence of "Things in themselves" if the term be taken in its rigid meaning.

The "thing" is constituted by a definite form, using the word "form" in its evident significance. A chair is a seat with legs and a back serving the purpose of sitting. The form of the chair is the "chair in itself," if that term has any meaning at all. There is not an unknowable "chair in itself" of metaphysical existence which germ-like exists as a power, or a force, or a potency in the material that is being turned into a chair by the skill of a carpenter.

Accordingly, we may say, there are "forms in themselves," but not "things in themselves." Itselfness, or absoluteness, is not any thing substantial but purely formal. Those eternal uniformities which are classified by scientists as laws of

nature are the conditioning factors of things. They are the moulds of all beings animate as well as inanimate; but there is not any "potentia" which germlike, in a process of unfurment, evolves the actualised things of real existence. I said :

"Evolution is not, as the name suggests, a process of unfolding; evolution is, as Christian Friedrich Wolff calls it, an 'epigenesis,' i. e., the process of the additional growth of new formations. The chick is something different in kind from the egg. The unity of the egg-cell organism in the yolk is radically different from the unity of the full-fledged chick. The former shows traces of irritability but not of consciousness, while the latter exhibits unmistakable symptoms of psychical activity. The formation of the chicken-soul is a new formation as much as the growth of feathers. The feathers of the chick are an additional growth; there are no latent feathers in the egg. We might express ourselves to the effect that the egg contains the potential existence of feathers, but with the same logic we might say the egg contains a potential chicken broth."

Here the term potential is incidentally introduced and the following remarks are made to show that potential existence is practically identical with that which is possible, but cannot denote either mystical "forces," or "metaphysical entities," or "things in themselves." I said in the same article :

"The terms potential existence, and latent qualities are fertile and useful ideas but we must beware not to employ them incorrectly. Any heap of iron ore may be called a potential sword. This is a mode of speaking which expresses the possibility that the ore can be changed somehow into a sword. But the sword does not exist at all in, not even as a latent quality of, the ore. The ore has no latent qualities of that kind. Those qualities of the ore which represent the potential sword are very patent to everybody who knows the art of using them properly and changing them into an actual sword."

"We may say that the hen's egg contains a potential chick; but this is a mere mode of speech devised to say that the egg can be changed into a chick under certain conditions. There is no chick at all contained in the egg and nothing that is like a chick."

Having read Mr. Bright's criticism I see not one word in the objectionable passages which I would retract. I have used the word potential in the traditional sense as that which can be (*τὸ καὶ δύναμις*) and deny only that the egg (the thing which can become a chick) is or contains a chick. An egg is a plexus of physiological tissues, a thing which is radically different from a chick, the latter being a living animal, a physical entity, a being endowed on a small scale with sensation, intelligence and purposive action or will, all of which qualities are glaringly absent in the egg.

The quotation of the objectionable passages in their context seems to me sufficient to dispose of Mr. Bright's criticism were the problem not more complicated and deserving of more elaborate treatment. The opposition which Mr. Bright makes

is based upon a difference between the egg and the chicken broth. I am quite aware of this difference and would be the last to deny its importance. I only deny that there is any difference between the two except a difference of kind. The difference is that in one case the most salient factors lie in the egg itself, and in the other they lie somewhere else; but in neither case do they lie exclusively here or there, nor is the potentiality any mysterious disposition in the egg, as a thing that remains identical through all changes.

In Aristotle's philosophy the term potential (*καὶ δύναμις*) plays an important part. The potential is contrasted with the actual i. e., that which has been perfectly realised (*καὶ ἔντελος*). The art of architecture may be called the potentiality of housebuilding as may also the material of which houses consist:

Schwegler says (as quoted by Fleming in his *Vocabulary of Philosophy* p. 11, *sub voce* ACTUAL):

"The relation of the *potential* to the *actual* Aristotle exhibits by the relation of the raw material to the finished article; of the unemployed carpenter to the one at work upon his building; of the individual asleep to him awake. *Potentially* the seed is in the tree, but the grown-up tree is it *actually*; a potential philosopher is the philosopher not philosophising; even before the battle the better general is the potential conqueror; in fact, everything is potential which possesses a principle of motion, of development, or of change; and which, if unhindered by anything external, will be of itself. *Actuality* or *entelechy*, on the other hand, indicates the perfect act, the end as gained, the completely actual (the grown-up tree, e. g., is the *entelechy* of the seed-corn), that activity in which the act and the completeness of the act fall together, e. g., to see, he thinks and he has thought, he sees and he has seen, are one and the same, while in these activities which involve a becoming, e. g., to learn, to go, to become well, the two (the act and its completion) are separated" (Schwegler, *Hist. of Phil.*, Stirling, p. 108).

The words "potential" and "possible" are derived from the same root, and mean etymologically the same, signifying that which can be. But potential is more closely related to the noun *potentia*, i. e., power (*δύναμις*) of potency which conveys the idea of a dynamic conception of performing some deed or attaining some ideal aim. And this linguistic implication actually seems to dominate Mr. Bright's thoughts, for again and again he speaks of the "power" of the egg to become a chicken, which "is a quality inherent in its constitution." He also speaks of "the persistent forces immanent in the egg." He says "the word potential relates to potency and not to substance" and defines potential as follows:

"For a thing to be a potential something else it must contain the power in itself, as a quality of its own nature, to become or produce that something else."

Aristotle's conception of potential differs from Mr. Bright's, but we shall not enter into questions of purely historical importance. Everybody has to a certain extent the right to form his own terminology. But then we must insist upon the utter indifference of the dynamical forces stored up in the egg and the paramount

importance of the form in which they are arranged. We do not know the secret of this arrangement, but we know that the energy stored up in an ostrich egg or in an eagle's egg, or in a chicken's egg, is not the determinant factor of the future fate of the egg, but its constitution, viz., the arrangement of its chemical ingredients. Neither the mass of the germ substance which is minimal seems essential, nor do the forces of the tiny little bit of energy contained in the substance seem to play a prominent rôle in the process. Everything depends upon the form which in its minute details is still unknown to us. Forces or power (viz., mechanical energy) is added to the egg from the outside by brooding and also some substance, especially oxygen, is admitted through the process of the shell. The external world co-operates in bringing about the result of the development of the egg; and this co-operation is indispensable for bringing about this wonderful transformation which changes an egg into a little chick.

There is a little German toy in the market called, I believe, "The little artist." It is a figure with a pencil in hand, the arm being moveable and connected with levers leading to a wheel underneath upon which a pattern of two lines cut in zinc can be placed, the one determining the vertical position of the pencil, the other the horizontal. The pattern can be changed, and the little artist draws pictures as soon as the crank is turned, and, of course, the pictures depend upon the pattern. Here the pattern is the potential picture. The pattern is not a picture at all; it contains no picture, nor does it in any way resemble a picture. Yet the form of its lines will, if inserted into the little machine, guide the pencil and thus produce a definite picture.

Potentiality is neither a matter of power nor of substance, but of form.

Mr. Bright believes that if an egg is transformed into a chick, it must contain a chick. He says:

"The adage is 'like begets like,' but if nothing is contained in a hen's egg that is like a chick, it is evident that nothing that is like a chick could come out of it."

The truth is that very frequently and undeniably things of one kind are changed into things of another kind. A heap of nebulous gases is changed into a solar system; the fiery surface of a planet cools down and is transformed into a theater of life and moral aspirations. Hemp is woven into clothes, worn to rags and at last turned into paper to become books. Everywhere we are met with transformations where radically new things appear which can not be said to have existed before potentially anywhere except in the ideal realm of the possibility conditioned by the eternal laws of form and actualised through the changes wrought by combination and separation.

Mr. Bright's error is based upon a misconception of what he calls the equivalence of energy. He says:

"According to the law of transformation and equivalence of energy the human mind is forced to conclude that everything that appears in the transformed and actual state of a thing must have had its equivalent in the former, or potential, state."

from which it was transformed. Therefore, as the chick is but the transformed state of the egg the conclusion that the feathers on the chick had their corresponding equivalence in the forces of the organic constitution of the egg, cannot be avoided."

Every thing is some thing and can in combination with other things be changed into innumerable new things. The new things are the potential things of Aristotle and to speak of them as being contained in the old things is, to say the least, very misleading. Mr. Bright says:

"When we say a thing *contains* something we have distinctly *two* ideas in our mind. As when we say the bottle contains wine. Here the bottle is one idea and wine is the other. Likewise when we say the egg contains something. In this case, however, we do not refer to the egg-shell and its material contents, as in the case of the bottle and its contents—the wine. But the concrete egg with its nutritive potency or energy is one idea; and the formative potency, or organising efficacy inherent in the egg-cell in the yolk is the other idea. The egg in its totality possesses these two distinct classes of energy—formative and nutritive. The concrete egg contains an abstract and unknown quantity. And when we reduce this super-sensuous, unknown quantity to a physical expression,—not by any rules of mathematics, but by gentle heat in an incubator or under a hen,—we find it equals a chick."

Aristotle's usage of the term potential and actual is not very satisfactory; but when he says that certain things are possessed of potentiality, he uses a figure of speech meaning that they can be transformed. Mr. Bright insists on the egg as containing a potential chick, saying that "the concrete egg contains an unknown quantity" which by brooding is reduced to a physiological expression, called a chick!

That "unknown quantity" of which Mr. Bright speaks is no quantity, but a quality; it is a definite form, analogous to the form of a pattern in machines.

We must insist that the term potential, convenient as it may be for many purposes, is dangerously ambiguous. The potential is that which will be or may be, but it is not contained in the things from which, or in minds of people through whom, it is actualised.

An American boy baby may be called a potential president of the United States, but for that reason he does not contain an unknown quantity of any kind. Aristotle speaks of dissolution as inherent in compound things, (book IV., ch. xi.) which means that all living bodies are subject to decay, or to use Mr. Bright's terminology "contain potential corpses."

Obviously, it is dangerous to take figurative terms seriously and understand them in a literal sense.

And why is the potential egg of special interest? Because it is the typical illustration of a wrong conception of the development of the world, based upon a false allegory. The world egg plays a prominent part in almost every mythology.

"The difference between an egg and the primitive condition of world system, is this: A chicken existed before the egg, and the egg develops a chicken because it represents the life-memories of many millions of chicken ancestors. The egg would not exist but for the hen. The hen transmits certain forms of motion which are the sum total of all the experiences of herself and her ancestors to a part of her body, *the ovule*. The ovule, when fertilised, grows and is excreted as an egg.

The famous question, "Which was first, the hen or the egg?" must be answered: "Neither." Living protoplasm was first, which under certain conditions produced the egg-bearing hen.

In a certain sense a nebula contains all the conditions for producing a planetary system and, on the surface of its planets, of living beings such as we are. Matter, the substance of a nebula, it must be assumed, possesses the qualities of motion and irritability, which by proper organisation become sentiency. The world-material can, merely through certain combinations in a long process of evolution, develop the higher forms of existence, organic life, consciousness and rational will. This evolution is inherent in existence through that impalpable something which we call laws of form; yet there is nothing in the world-process that evolves transmitted memories containing a special form of life and that form only. There is no world-hen who imparted her experiences and intelligence to the produce of her creatures.

A stellar nebula is a potential solar system, animated on its planets with rational beings. So the egg is a potential chick. The development of both is determined by their constitution, but while in the former the eternal laws of nature seem to play the most important part, the latter is typically a repetition of prior action and is a new start for the reappearance of the type of its ancestors.

The law of the conservation of matter and energy declares that the sum total of all energy and the sum total of all matter remain constant in the entire system of the universe. That which is not constant is the form; and new forms can be produced from the old forms in an unlimited amount of possibilities. But the changes of form take place according to eternal laws of form the recognition of which assists us both in tracing the process of evolution and in forming as well as realising our ideals of life.

P. C.

BRINTON'S THEORY OF THE ORIGIN OF RELIGION.

In the winter of 1891 a movement was started in Philadelphia for the purpose of instituting popular courses in the History of Religions. Each course was to consist of from six to eight lectures and the engagement of lecturers, choice of subjects, etc., were to be in the hands of a committee chosen from different cities and representing various institutions and associations. The first course was given by Prof. T. W. Rhys-Davids, Ph. D., LL. D., of London, England, on the subject, The History and Literature of Buddhism. As the second lecturer, the late Prof.

Daniel G. Brinton of Philadelphia was chosen, and he delivered a course of six lectures on the Religions of Primitive Peoples. These lectures were delivered during the winter of 1896-1897 and they have since appeared in a neat volume issued by G. P. Putnam's Sons of New York.

Dr. Brinton, who at the time of his death held the chair of American Archaeology and Linguistics in the University of Pennsylvania, was a leading authority on the language and customs of the American Indians and on Anthropology in general. As is well known, he was a careful student of his chosen subjects and a most prolific writer. In several of his books and articles he turned his attention to religion, but nowhere has he given the subject so thorough a treatment as in his latest work. He there presents, with a large accumulation of facts in regard to early religious beliefs and practices, a theory of the origin of religion which it is the purpose of this article to consider.

As is usual with writers on religion Dr. Brinton begins by stating the various theories in regard to its origin and after a brief consideration of each rejects them all. It is necessary, he says, if we are going to apply the scientific method to the study of religions to offer an intelligible explanation of their existence, an explanation which is verifiable and which holds good for all of them, primitive or developed. This, he thinks, has not been done up to the present time.

Having cleared the ground, he lays down the proposition that "the psychic origin of all religious thought is the recognition, or, if you please, the assumption, that *conscious volition is the ultimate source of all force*." It is his belief that "beyond the sensuous phenomenal world, distinct from it, giving form, existence and activity, lies the ultimate, invisible, immeasurable, power of Mind, of conscious Will, of Intelligence, analogous in some way to our own; and—mark this essential corollary,—*that man is in communication with it*" (p. 47).

This, on the face of it, may not appear to be markedly different from the theories in vogue since Tylor and others set forth the principles of animism, but it is quite different as the careful capitalisation of mind, will, and intelligence in the above quotation might be taken to indicate. His real postulate is that the primitive man recognised that all he saw about him was but a manifestation of an impersonal, spiritual Power lying beyond or behind reality. That he accredits the primitive man with the degree of philosophic insight necessary for the recognition of this rather modern philosophic doctrine is evident from many passages in the book. I will quote but one: "The idea of the world-soul, manifesting itself individually in every form of matter from the star to the clod, is as truly the belief of the Sioux Indian or the Fijian cannibal as it was of Spinoza or Giordano Bruno" (p. 135). I do not misrepresent his theory then, when I say that his fundamental postulate is that of a universal intelligence which is recognised by primitive men. He does not seem to have reflected upon the well-known fact that Spinoza was persecuted and Bruno was burned for their belief in the animation of all matter.

Now, the question at once arises, How did this fundamental idea, this primitive

"conception of the Divine" originate? Dr. Brinton is ready to explain it, and in attempting to do so he resorts to a method which is ingenious, whatever we may say of its scientific value.

We all know what an interesting region in psychology is that known as the subliminal consciousness. We know that, as yet, only its boundaries have been explored. We know not what curious facts its further exploration may reveal. It is unsafe to predict what may or may not be found in it. I know not what may have induced Dr. Brinton to turn to this comparatively unknown territory for an explanation of the fundamental religious idea; but, at all events, he does do so and sets it forth with all the confidence and satisfaction of a discoverer. It is not the product of any conscious act of intelligence or any process of voluntary reason, he tells us, it comes "from the unknown, the unplumbed abyss of the sub-conscious mind." "In the subliminal consciousness, or psychic automatism, I have revealed to you," he declares, "the true source of the conception of the Divine."

It is difficult to see how this conception of the Divine could be derived from the subliminal consciousness, unless in the subconscious action of the mind we have a real manifestation of Divinity, and Brinton does not seek to avoid this conclusion. He evidently accepts it, but he points to no facts to prove it; simply because there are no such facts. One terminus of his thought lies beyond the boundary of fact and consequently of science. Even if we should grant that he has discovered the true source of the conception of the Divine, we should still wonder by what authority he gives so high a value to a conception derived from so uncertain a source. The lameness of his whole argument may be seen in the following statement: "Who dare deny," he says, "that in their unconscious functions our minds may catch some over-tones, as it were, from the harmonies of the universal intelligence thus demonstrated by inductive research (sic) and vibrate in unison therewith?" Who, indeed? But, on the other hand, who dare affirm such a proposition as a scientific fact. It seems to the ordinary mind that such uncertain statements should have no place in a book which professes to apply the scientific method to the study of religions.

With this universal intelligence now and then revealed through subconscious mental action, we can see why Animism, the belief in individual spirits, or Comte's theory of the progress of religious development through fetishism, polytheism, and monotheism, must, in Dr. Brinton's opinion, fall to the ground. There is no real distinction between fetishism and idolatry, for the thing worshipped is not the object itself, or an individual spirit resident in the object, but "a transcendental *X*" manifesting itself through the object.

Now, I think it is easy to show, and it has been shown by Tylor and others, that in order of time the idea of individual spirits preceded the idea of a world spirit, and it is difficult to see how Dr. Brinton could contend for the opposite in the face of the vast array of facts which gleam from almost every modern work on anthropology and even from the pages of his own book. It would seem that the

general idea of a universal intelligence, when reached at all, would be arrived at either from a generalisation of beliefs in individual spirits, or from a philosophic speculation in regard to the nature of the universe far beyond the mental ability of the primitive man. What does the primitive man know about will or mind? Nothing at all. His first generalisation is, perhaps, in regard to objects which move without visible cause. He has accomplished, for him, quite an intellectual feat when he concludes that such objects are alive and infers that they are individual beings like himself. The natural outcome of his thought is Animism. But, Dr. Brinton declares that while Animism, in one guise or another, "is common to all religions and many philosophies, it is merely a secondary phenomenon of the religious sentiment and not a trait characteristic of primitive faiths." But this declaration is denied by the very facts which he presents. Quoting a remark of Professor Sayce in regard to the early Chaldeans to the effect that to them the spiritual was that which manifested life and the test of life, which was movement, he adds, "this is universally true of primitive faiths." This seems much more probable than that in primitive faiths the universe was regarded as alive. Again, he does not seem to see the implication of his explanation of the process of thought by which the primitive man assigned mind to nature. It is illustrated, he says, in the action of any child, and he then uses the familiar illustration of the gratification of a child on seeing an object which has in some manner injured it punished as a living being. A similar process takes place in the mind of primitive man. "Wherever he perceives motion independent of a living being he assumes the presence of a conscious agent not visible to his senses" (p. 49). The obvious implication of this fact is Animism; but, Dr. Brinton does not see it so. It is much more likely that the primitive man regarded motion in nature as evidence of life in the particular object under observation than that he reached a conclusion that it was the immediate exhibition of a universal will. Dr. Brinton virtually presents the untutored savage as a primitive Emerson speculating on the doctrine of the over-soul. All that is true in his theory is to my mind animistic, and that which is not true is subjective and is carried to the facts, not found in them.

In illustration of the last remark I may refer to his theory of the subconscious intelligence as an explanation of the primitive religious conception. I know no better illustration of reading a theory into the facts, of carrying back one's own conceptions into the crude philosophy of primitive men. The "philosophy of the unconscious," the theory of psychic automatism, is modern. Suggestion and hypnotism have only recently been the subject of psychic investigation. But, since psychology proclaims, with more or less certainty, the existence of a subliminal consciousness, it is at once seized upon and carried back into primitive philosophy as an explanation of the thought of primitive man. This "unplumbed abyss of the subconscious mind" offers undoubted opportunities for angling; but it is surprising to find Dr. Brinton, a scientist, fishing out of it the primitive conception of the Divine.

But a still more unscientific proceeding is the identification of the subconscious mind with the Divine mind, and this, as I have said, Brinton virtually does. He speaks of the Shaman and the Medicine Man as having been "face to face with God, having heard His voice and felt His presence" (p. 58). They are inspired by a contact with the divine intelligence, and in this state of inspiration we find the "psychic development" of the primitive idea of the Divine, the notion of God.

Speaking of inspiration in this special sense, we are not surprised to find Dr. Brinton making far more of it than facts justify. With him such an almost mediumistic inspiration is the basis of every religion. He distinctly declares that there can be no religion without it.

Now, nothing seems more clear than that this idea and the spiritualistic conception of a doctrine of inspiration are a direct outgrowth of the phenomena of possession and obsession which are yet to be explained. It is quite gratuitous to say at this stage of psychological investigation, as Dr. Brinton does, that "the human soul, regarded in its origin as an emanation of the Divine, is in its nature omniscient, when in moments of ecstasy it frees itself from its material envelope" (p. 51). So-called inspiration may be due to the operation of the subliminal consciousness; but to refer one unexplained phenomenon to another unexplained phenomenon can hardly be regarded as a scientific explanation. There can be no doubt that the mental states now studied under suggestion and hypnotism, etc., have played a great part in all religions. But it cannot correctly be said that religion is due to them. Manifestations of the subconscious intelligence were, doubtless, to the primitive man like all other inexplicable phenomena, or, rather, like all other phenomena which he could explain on no other hypothesis than to assign them to the influence of the gods.

In the theory of Dr. Brinton, and in many passages in his book, there are evidences of a theological bias. Doubtless this bias, and his undue haste to utilise some half-formed conclusions in psychology, led him into the vagaries of his theory of the origin of religion. As evidences of this theological bias many passages could be cited, but one must suffice. In speaking of certain ceremonies connected with primitive religions he says: "The Psychologist sees in them all the same inherent tendency, the same yearning of the feeble human soul to reach out towards and make itself a part of the Divine Mind" (p. 191). We can easily imagine the palatability of such a remark to a certain class of theologians who have much to say about the bankruptcy of science.

There is one other criticism which applies not so much to Dr. Brinton's theory of the origin of religion, as to his idea of what constitutes religion. In my opinion he falls short of a true understanding of the nature of religion. Religion is not a "notion of the divine," as he implies; nor is it a belief, or a system of beliefs. If he had the true conception of the nature of religion, he could never say, as he does (p. 53), that there can be no religion without inspiration or that every religion is a revelation. Religion is not "a system of activities to obtain beatitude, blessing,

righteousness, truth, and wisdom, as the chief good by enlisting the good offices of unseen beings in the unseen world."¹ Religion should be carefully distinguished from beliefs about religion. Most of the attacks aimed at religion have been in reality directed against theology. The editor of this journal advocates with great earnestness and intelligence, a religion of science, but in the sense in which I use the term religion, and which, in my judgment, is the correct meaning when speaking of its origin, there can be no such thing. What is really meant is that the beliefs growing out of religion should be purified by science; that is, that there should be a science of religion rather than a religion of science. Religion, traced back to its origin, is the recognition on the part of primitive men, or of members of sub-human species, that there were powers or agents outside of themselves which might help them or harm them, and the desire to be in right relation with these agencies. The desire arose from fear of agencies which, by the primitive mind, were interpreted as spiritual, and the hope of propitiating these agents led to acts of worship. Religion appearing in the individual was through a sort of principle of spontaneous variation laid hold of by the social group and utilised in the construction of religious systems. Knowledge and belief, hope and desire, are all, then, at the basis of religion.

If this conception of religion is correct, the theory proposed by Dr. Brinton in his study of primitive religions is deficient in that it not only gives a poor explanation of the phenomena which it starts out to explain, but it also seeks to explain a phenomenon which is not religion. I. W. HOWERTH.

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A STRANGE ATTACK ON SOME PHYSICAL THEORIES.

In the October, 1899, number of *The Monist* appeared an article by the Hon. Chas. H. Chase on "The Doctrine of Conservation of Energy in Its Relation to the Elimination of Force as a Factor in the Cosmos." The writer's main object is to show that all energy cannot be explained, or expressed, in terms of motion, and that force cannot be identified with kinetic energy. Whatever the validity of these theories may be (and they are certainly not original with Mr. Chase), I would like to call attention to some of the mathematical reasoning by which Mr. Chase claims to have established them beyond all doubt.

He starts his mathematical "demonstrations" by telling us that, in the collision of two inelastic bodies of masses m and m' , moving with velocities v and v' , the momentum M and the kinetic energy E , before collision, are given by the formulas, $M = mv + m'v'$, and $E = \frac{1}{2}mv^2 + \frac{1}{2}m'v'^2$; and, after collision, by the formulas, $M' = \frac{1}{2}(m + m')(v + v')$, and $E' = \frac{1}{2}(m + m') \frac{(v + v')^2}{4}$. He says that, ac-

¹ Major Powell in *The Monist*, January 1898, p. 187.

cording to these formulas, the quantity of motion remains unchanged by the collision, whereas the kinetic energy will "in general be different in magnitude, and $E > E'$ "; that, by collision, therefore, some energy "disappears," but "motion" is "conserved"; that the energy E' is due to the total motion of the system, and that, therefore, if there is any potential energy, this energy cannot be due to motion, but must be due to force. All this line of argument he prefaces by saying that the theory that potential energy is a form of motion is an "obvious error," and that "the (mathematical) demonstration of the impossibility of such a position is so simple," that he is surprised to see that it has escaped the attention of expert mathematicians.

It will be seen that Mr. Chase has not concerned himself very much about splitting hairs. He has cut the Gordian knot by applying the all-powerful and most "practical" method of *averages*. To find the velocity of the impinging bodies after impact he simply takes the *mean* of their velocities before impact. This done, the rest might be expected to follow smoothly, according to mathematical principles. But even here Mr. Chase seems to have ideas of his own. He tells us that, *according to the formulas*, there is no loss of momentum; that is, we must have, $M = M'$, or $mv + m'v' = \frac{1}{2}(m + m')(v + v')$. It is easy to transform this equation and reduce it to the form, $m(v - v') = m'(v - v')$, and this requires that we should have either $m = m'$, or $v = v'$, or both $m = m'$ and $v = v'$. Mr. Chase's first unsuspected discovery is, therefore, when properly "generalised," that *all the bodies in the universe have either the same mass or the same velocity, or both the same mass and the same velocity*.

The other equation, $E' = \frac{1}{2}(m + m') \frac{(v + v')^2}{4}$, leads to an equally interesting and astounding conclusion. Suppose m' to be originally at rest. Then $v' = 0$, and E' may be made as great as desired by increasing m' ; and, since E is in this case independent of m' , the difference $E' - E$ may be made as great as we please. That is, we may *create* any amount of energy. The application of this "new principle" to the vexed problem of perpetual motion is a simple question of mechanism. The second discovery of Mr. Chase is, therefore, that *with any amount of kinetic energy ($\frac{1}{2}mv^2$), however small, we may CREATE an unlimited amount of energy of the same kind*. This "law" can be applied in "practice" with most wonderful results. Thus, a 10,000-ton man-of-war, hit from beneath by a bullet weighing 2 or 3 ounces, could easily be hurled up into the air with a velocity of 1000 feet per second.

Of course, it is scarcely necessary for me to say that Mr. Chase's great error consists in assuming the velocity after collision to be a mean between the velocities before collision. It is well known that the final velocity is $M/(m + m')$, and that the final *molar* kinetic energy is $E - \frac{1}{2} \frac{mm'}{m + m'}(v - v')^2$.

Mr. Chase further concludes, from some simple mechanical formulas the exact meaning of which does not seem to be very plain to him, that "it is evident that

kinetic energy is not wholly dependent on matter and motion." Mr. Chase will not, we hope, accuse us of promulgating "errors" and "absurdities" if we tell him that, by *definition*, kinetic energy is energy due to motion; indeed, the term is often defined by mathematicians as a name given to the product $\frac{1}{2}mv^2$. What would a mechanician say to any one who told him that the velocity of a moving body does not depend upon time and space?

Prof. C. L. Morgan referred somewhere to the arguments of some vitalists, founded on the principle that a force acting constantly in a direction normal to the path of a moving particle cannot alter the kinetic energy of the particle. This is a well-known principle of dynamics, and is found in every elementary text-book. Mr. Chase, however, takes the Professor and the vitalists to task, and says: "The vitalists to whom Professor Morgan refers were ignorant of mechanics, or he has misquoted them; and in either case he seems not to have discovered the mathematical absurdity involved." To expose this "absurdity," Mr. Chase assumes a particle moving in a straight line with a velocity a . When the particle is at a certain point, a force is "impressed" on it "sufficient to give it a velocity b ," the direction of the force being normal to the path of the particle. He draws a parallelogram whose sides are a and b , and says that the resultant motion will be in the direction of the diagonal, with a velocity equal to $\sqrt{a^2+b^2}$. The kinetic energy of the particle, after the action of the force, will be $\frac{1}{2}m(a^2+b^2)$; that is, the force has increased that kinetic energy by an amount equal to $\frac{1}{2}mb^2$, and this is contrary to the principle maintained by (or wrongly attributed by Professor Morgan to) the vitalists.

Here again Mr. Chase seems to be somewhat confused. The principle in question affirms that a force does no work (this being another name for change of energy) when the path of its point of application *remains* normal to the direction of the force while the force acts. In the present case, we have an unconstrained particle, which, on being acted upon by the impressed force, leaves its rectilinear path and moves in the arc of a parabola (not in a straight line, as Mr. Chase seems to think). While the force acts, it is no longer normal to the path of the particle, and does an amount of work whose measure is obtained by projecting the path on the line of action of the force, and multiplying the projection by the magnitude of the force. Perhaps Mr. Chase was thinking of an impact when he spoke of an "impressed force"; but this does not alter the general principle, the only difference being that here the force acts through a very short distance.

ANTONIO LLANO.

BOOK REVIEWS.

Die WELTRÄTHEL. Gemeinverständliche Studien über monistische Philosophie.

Von *Ernst Haeckel*, Dr. philos., Dr. med., Dr. jur., Dr. scient., Professor an der Universität Jena. Bonn : Verlag von Emil Strauss. 1899. Pages, viii, 473.

A presentation of the world-problem is the subject of Professor Haeckel's latest book, and he apparently intends the book to be a summary and conclusion of his life's work. It contains a *résumé* of his studies in the line of natural science, viewed under a philosophical aspect, and presents as the solution of the world-problem the theory of monism. The book is written in the brilliant style for which all the writings of Professor Haeckel are known, and will not fail to make a deep impression upon the reading public.

Professor Haeckel complains in the preface that the nineteenth century,—a century of the development of natural science,—did not bring about a satisfactory clarification of the problems of philosophy. Philosophy, such as it is taught at the universities, is still far removed from the ideal which he would like to enthrone in its place. It is purely metaphysical and deals with abstract problems which have little or no foundation in fact, and make little or no use of the enormous treasures brought to light by the various natural sciences. On the other hand, the representatives of the exact sciences have become mere specialists, and turn their backs upon the problems of philosophy, thus ignoring a cognition of the deeper interrelation of the facts which they discover. Many scientists deem philosophy redundant. They do not see the woods but only single trees, while *vice versa* the metaphysicians see the woods only, without taking note of the trees; and the nature-philosophy, which would unite both in a harmonious world-conception, is still repugnant to large circles belonging to either of these factions. With the purpose of filling this gap, Professor Haeckel publishes his book on world-problems, which, though it may have shortcomings, is as he states at least honest from the beginning to the end, and expresses his deepest convictions as "the matured fruit from the tree of knowledge," such as he knows it.

The book is divided into four parts, treating first of anthropological, secondly of psychological, thirdly of cosmological, and lastly of theological problems. The

first part discusses man, the system of his body, his origin, his life, and the history of his race. The author then introduces us to the soul, calling the nervous substance "psycho-plasm," and objecting to a dualistic psychology, rejecting the immortality-idea as held by the dualistic philosophers. The basis of a cognition of the world is to him "the law of substance," by which he understands the preservation of matter and energy. The Christian God-idea is discarded as an impossibility on the same ground on which the dualistic theory of the soul has been found unacceptable.

In the concluding chapter, entitled "Solution of the World-Problems," he declares that the world-problems have been solved by the various natural sciences: astronomy, geology, physics, chemistry, biology, and anthropology. He grants that some problems, such as the origin of life, have not been definitely settled, but there is no reason on that account for mystification of any kind, because we can after all know positively that law governs the world, and that the monistic philosophy has proved a satisfactory solution. Haeckel concludes with Goethe's words: "According to eternal and iron laws must we all complete the circles of our being."

Professor Haeckel is the champion of mechanical and materialistic monism, and as such he is its best and most classical exponent. That he is frequently one-sided is well known, and we have repeatedly called attention to some of his shortcomings; but his one-sidedness is nothing in comparison to the one-sidedness of his opponents, the Ultramontanes and other anti-evolutionists. Professor Haeckel's readers will easily condone the vigorous language which he uses when exaggerating the crude conception of an antiquated theology. We venture to say that the Christian world (at least in America) also has moved onward, and I believe there will be few left among the ranks of clergymen who would still represent their God as "a gaseous vertebrate." On the other hand, Professor Haeckel might find some truth in the traditional religious ideas, such as is for instance the anthropocentric conception which he vigorously criticises. It is true after all that the world-process on earth culminates in man. In the struggle for life a number of living beings develop, and every one of them may regard itself as the center of the universe; but after all the tendency of the development of the world is to produce a rational being, and this rational being reveals best the harmony of the cosmos, as its purest and most ideal product. It is the development of the truly human which would lead men above the present defects of our civilisation, and help to cultivate the humanity of man by freeing our institutions from the barbaric relics of past ages, an aspiration which Professor Haeckel shares with all lovers of reform. In this line, especially on the reform of school and church, Professor Haeckel's remarks are quite in order, and he might find sympathy even among his very opponents.

Whatever standpoint the reader may take, he has in Professor Haeckel a man who is truly representative, and there can be no question that the book will make a strong impression.

P. C.

EINLEITUNG IN DIE VERGLEICHENDE GEHIRNPHYSIOLOGIE UND VERGLEICHENDE PSYCHOLOGIE. Mit besonderer Berücksichtigung der wirbellosen Thiere. Von Dr. Jacques Loeb. Mit 39 Abbildungen. Leipzig: Verlag von Johann Ambrosius Barth. 1899.

Prof. Jacques Loeb has been doing sound and important work in his laboratory at the University of Chicago, and evidences of it have appeared from time to time in little monographs, some of which have been mentioned in former numbers of *The Monist*. The results of his labors are not without important consequences and appear calculated to throw new light on the vital questions of physiology, evolution, heredity, and the general principles of the natural sciences. We are therefore much pleased that he has now published the results of a great part of his labors in a condensed form in the present book, which is a continuation of the author's researches on the heliotropism of animals.

The author had shown that the heliotropism in animals is in every way identical with the heliotropism in plants. On the other hand the tropisms of animals are reflex actions or instinctive actions; for instance the flying of the moth into the light. As everybody knows, the generally accepted theory of reflex or instinctive actions takes it for granted that they are determined by specific structures in the ganglia. But this assumption became doubtful through the author's proof of the identity of animal and plant tropisms. Hence it was necessary to investigate whether the ganglionic theory of reflexes is not after all an arbitrary, unnecessary or even false assumption. The author contributes a number of facts which show that the reflexes are determined by the arrangement of the muscles or the contractile elements on the one hand and the sense organs or the irritable structures in the skin of the animal on the other, and that the central nervous system only acts as a protoplasmic conductor for the transmission of stimuli from the sense-organs to the muscles.

Among the proofs for this the following may be mentioned. In ascidians the whole central nervous system consists of one single ganglion which can easily be removed, but these animals differ from higher forms in that the stimuli can be transmitted directly from element to element of the body without the interference of the central nervous system. These organisms possess a typical reflex and if one touches them they close their openings and contract. The author found that the same reflex continues after the removal of the central nervous system. Hence this reflex cannot be determined by hypothetical specific structures in the ganglion, but must be determined by the arrangement of the muscles of the animal.

The author further shows that in higher animals matters are not different. The closing of the pupil under the influence of light is considered a typical reflex action in which the stimulus is carried through the optic nerve to the central nervous system and from here back through the oculo-motor nerve to the iris. Specific structures which determine these peculiar reflexes are considered to be located in the ganglia or centers for the reflex. Yet it has been known for a long time that in an excised

eye the same reflex action still occurs under the influence of light. In this case, of course, the light causes directly the contraction of the muscles of the iris. Hence this peculiar reflex is determined not by hypothetical structures in the ganglionic cells but by the arrangement of the muscular fibres of the iris. Another example is offered by the reflex of the bladder and the anus. It has been shown by Goltz and Ewald that these reflexes continue even after the destruction of the spinal cord.

Hence it is impossible that these reflexes are due to hypothetical specific structures in the ganglion cells; they must be due to specific structures and irritabilities of the peripheral organs themselves.

While we then become convinced that the central nervous system does not contain the specific structures for the reflex organs but is acting only as a conductor, and moreover, that in some cases the reflexes continue after the ganglia or the spinal cord are extirpated, it does not as yet follow that the ganglia or the spinal cord are redundant and without consequence. In another set of experiments Professor Loeb showed what the true function of the nerves is in such cases. Ascidians can exist, both with and without nervous system, but on determining the smallest intensity that is needed to produce their specific reflexes we find that a reaction is quicker in the animal with central nervous system than in the one from which it has been removed. This fact reveals to us that the central nervous system acts as a more sensitive and accelerating conductor. An animal without central nervous system or without spinal cord may be able to show a number of reflexes and instinctive actions and adaptations, but it would not be able to adapt itself quickly to rapidly changing conditions.

What the author said in regard to ascidians also holds good for animals with a segmental nervous system. An annelid or an arthropod may be considered as a colony of segments each of which is comparable to an ascidian. Each segment has its reflexes which depend, as in the ascidian, not upon structures in each ganglion, but upon the irritabilities of the sense organs of the skin and the arrangement of muscles. The only difference is that stimulation of one of these segments not only causes an activity in the stimulated segment but in the other segments too, as the various segments are connected with each other by conductive protoplasm.

What however becomes of the leading rôle which the brain is generally assumed to play by modern authors? Professor Loeb shows that this so-called leading rôle of the brain no more exists than the hypothetical reflex structures in the ganglionic systems. In annelids, for instance, spontaneous locomotion continues even if you cut off the head of the animal. If we dissect fresh-water planarians, even pieces without brain continue to make spontaneous progressive motions. It was formerly assumed that frogs, pigeons, and dogs without cerebral hemispheres would no longer be able to show any spontaneous motions, but the experiments of Schrader and Goltz prove this to be an error.

Professor Loeb grants that there are cases in which animals no longer make progressive locomotions after the loss of the brain. For instance, decapitated sea-

water planarians and the cray-fish without brain no longer walk spontaneously. But he adds that we cannot explain why the motion stops. It would be wrong to draw the conclusion that in these animals the brain plays the leading rôle over the rest of the ganglia. For if we take out the cerebral hemispheres and thalamus opticus in a frog the animal loses its spontaneity but if we take out a little more the animal not only moves again spontaneously but moves incessantly. The same is true for the shark. Hence if in some cases we find that after the loss of the brain or part of the brain an animal loses its spontaneity this phenomenon has to be explained in a different way from that of assuming that the brain has a leading influence over the rest of the ganglia.

The same may be said in regard to the leading rôle of the brain in the co-ordination of motion. The co-ordination of motion can according to Professor Loeb be explained through the mutual influence of the various elements of an organism upon each other, and an assumption of a specific organ or ganglion of co-ordination would have to be regarded as a mere anthropomorphism. In the heart for instance the co-ordination of the variously active elements is due to the fact that that element which beats fastest forces the other elements to beat in its own rhythm.

When Friedlander cut an earth-worm in two and connected the two pieces by threads, the posterior part moved in a perfectly co-ordinated way as soon as the anterior part began to creep. But in this case the co-ordinated motions of the posterior half cannot be due to any influence of the brain, and Goltz's experiments prove that matters are not different in dogs. The reason that in some animals the loss of the anterior ganglion or the so-called brain has a greater effect than the loss of any other ganglion is that in these animals the peripheral parts of the anterior segments, i. e., the head, possess a higher differentiation with more sense organs and more tentacles than in any other segment.

This conception of the segmental character of reflexes is also true for the vertebrates, but while it is easy to prove it for invertebrates it has not as yet been recognised or positively shown to obtain in higher animals. Physiologists have a tendency to localise the seat of reflexes too high, that is say, too near the brain. Professor Loeb believes that the central nervous system is not built upon any other plan in the vertebrates than in the arthropods but that the difference is only based upon the peculiarity of the vertebrates, viz., that each operation in vertebrates is accompanied by severer shock-effects than in the arthropods. This has led to a number of misunderstandings. In the horse-shoe-crab the organs of respiration (gills) are situated at the abdomen. The segmental conception of the central nervous system demands that the nervous organs where these respiratory motions are started be situated in the abdominal part. We find, indeed, that if we destroy all the rest of the central nervous system leaving only the ganglia of the abdominal segments intact, that the respiratory motions continue after a short interruption in a perfectly normal way. The text-books however say that in vertebrates respiration is not determined by the segmental ganglia of the respiratory muscles but by

the *nœud vital* in the medulla oblongata. The argument on which their claim is based is that if we destroy this *nœud vital* respiration stops; but in this case respiration stops on account of the shock-effect which the operation produces upon the respiratory segmental ganglia. For if we take a newly-born vertebrate in which the shock-effects of the operation are considerably less severe we find that after destruction of the vital point in a medulla oblongata the respiratory motions continue and the organs for the respiratory motions therefore must be situated in the segmental ganglia of the respiratory muscles.

The segmental theory is of importance for the theory of localisation. That injury to the different parts of the cortex cerebri produces definite and different effects, is due to the fact that the fibres from the various segmental ganglia of the spinal cord in the medulla enter the cortex in different spots. Hence the so-called centres of the cortex must be simply regarded as the spots where the various sets of nerve-fibres enter the cortex. But Professor Loeb insists that it does not follow from this that these spots are the special seats of various functions; for instance, that, vision takes place only in the so-called visual sphere. It is perfectly possible or even probable that the processes underlying the psychic functions, e. g., vision, take place in the whole of the central nervous system or the whole cortex cerebri. The author offers facts obtained from Goltz and based upon the phenomena of association and interference of simultaneous innervations which would go far to prove that "the partial-soul theory" is an impossibility. The disturbances of function which follow the destruction of any of these centres of the cortex are due to a shock-effect upon the segmental ganglia with which the various centres are connected, and Professor Loeb mentions a number of experiments which would corroborate this view.

The animal tropisms form a considerable part in the complex of phenomena which constitute the subject of comparative psychology. But as animal and plant tropisms are identical we must admit that plants possess consciousness too if we call the cases of animal tropisms psychic phenomena. And further as the tropisms can be reduced to physical and chemical phenomena we would have to admit that psychic phenomena accompany every process in nature. Thus we would reach ultimately the assumption of soul-endowed molecules and atoms. Professor Loeb shrinks from this assumption. He tries to show that the conclusion of pan-psychism can be avoided by defining consciousness as a function of associative memory. This is his criterion that proves the presence of consciousness. By associative memory he understands that mechanism by which a stimulus not only produces the effects determined by the inherited structure of the organism and the character of the stimulus but also those additional effects of their stimuli which have made an impact upon the same organism simultaneously with the first stimulus. A simple example of this is that the odor of a flower, a purely chemical stimulus, reminds us of the shape and color of the flower itself. But how can we find out whether an animal possesses associative memory? If an animal can be

trained to do things upon a signal which are not necessarily determined by the physical effect of the signal it must possess associative memory (for instance if a dog turns around upon hearing its name called or if an animal is taught to look for its food upon hearing a certain sound, etc.). The application of this principle gives the result that there is no trace of memory in Coelenterates, in Echinoderms or in worms. Among arthropods and mollusks certain forms may possess associative memory but if this is the case it has yet to be proven. It is only certain that a number of vertebrates possess associative memory and hence are capable of having consciousness. Under the influence of narcotics, in the case of fainting, in deep sleep, associative memory comes to a stand still, but at the same time consciousness disappears too. On the other hand, in such cases where the existence of consciousness has been claimed and where no trace of associative memory can be found, a closer examination shows that the assumption of consciousness was due to a mistake. An example may be mentioned. If we injure a worm and the worm wriggles, we are inclined to believe that this is an expression of a sensation of pain. In this case the criterion for the presence of consciousness is based upon the assumption that the same cause produces in a human being similar motions which are accompanied by a sensation of pain. But Professor Norman has shown that if we cut a piece out of a worm and cut this in two, only the posterior half shows this wriggling motion, and if we go on dividing pieces of worms in every case the piece behind the cut shows wriggling motions while the piece in front of the cut does not show any motions which one might interpret as being due to a sensation of pain. Hence we come to the conclusion that a piece of a worm only has sensations of pain if it is behind the place of lesion while the same piece of a worm is devoid of the sensations of pain if it is in front of the lesion, which of course would be utterly absurd. The true explanation is that a stimulus in travelling backwards throws the longitudinal muscles into activity while the stimulus in travelling forwards throws the ring muscles into activity. In the latter case co-ordinated motions occur; in the former case the wriggling motions occur, but the interpretation that the latter are an expression of pain was wrong.

There are similar instances. Professor Bethe observed that if one cuts off the abdomen of a bee while it is sucking honey this injury does not disturb the bee in the least. The author takes up other instances in which psychic phenomena have been claimed among lower animals and shows that in these cases we have to deal only with erroneous anthropomorphic interpretations of simple mechanical effects of stimuli. Hence the author comes to the conclusion that consciousness exists only in certain species of animals and in these only after a certain stage of development has been reached. This view is opposed to the theory that consciousness is already present in the egg and develops together with the egg and increases with progress of its development. Professor Loeb ignores the facts of subconscious feelings and does not consider the theory that there are conditions of subjectivity in the atoms which are analogous to the consciousness of man. The subjectivity in lower

animals is mere irritability; it develops into sentiency, and then in higher animals into consciousness by what Professor Loeb calls associative memory, and is perfected in the self-consciousness of man. This by the way Professor Loeb holds is only possible from the time when a definite mechanism contained in the central nervous system, viz., the mechanism for associative memory, is fully developed, and that before this time no associative memory and hence no consciousness is possible. The sudden origin of consciousness need not surprise us as we see the same thing in the development of every other function. The heart beat is not contained in the ovum, and it is not developed gradually with the development of the egg but it appears after the heart is formed and after the heart has reached a certain structural development. The power of optical perception of space is a function of a certain form of eyes. Only such animals as have these eyes are capable of visual perception of space and even in those animals this power is not yet present in the ovum but only appears after the eye has reached a certain stage of structural development. What is true for the eye and its functions is true for that mechanism which Professor Loeb calls associative memory, without which consciousness is impossible.

The contents of the book are contained in nineteen chapters whose titles are as follows:

Ueber einige Grundbegriffe und Grundthatsachen der vergleichenden Gehirnphysiologie.—Ueber das Nervensystem der Medusen und über Automatie und Co-ordination.—Das Centralnervensystem der Ascidiens und die Bedeutung desselben für Reflexe.—Versuche an Aktinien.—Versuche an Echinodermen.—Versuche über die Gehirnphysiologie der Würmer.—Versuche über die Gehirnphysiologie der Arthropoden.—Versuche an Mollusken.—Die Segmentaltheorie bei Wirbelthieren.—Halbkreuzungen, assciirte Stellungänderungen der Extremitäten und Zwangsbewegungen.—Beziehungen zwischen der Orientirung und Function gewisser Elemente der segmentalen Ganglien.—Versuche am Kleinhirn.—Zur Theorie der thierischen Instincte.—Centralnervensystem und Vererbung.—Kriterien für die Constatirung von Bewusstsein bei niederen Thieren.—Gehirn und Bewusstsein.—Centrentheorie (Functionsslocalisation) und Segmentaltheorie im Grosshirn.—Theilseelentheorie und Localisation einzelner Erinnerungsbilder.—Ueber einige Angriffs-punkte für eine künftige Mechanik der Gehirnthatigkeit.

DIE GEISTIGEN UND SOZIALEN STRÖMUNGEN DES NEUNZEHENTEN JAHRHUNDERTS. By Dr. Theobald Ziegler. Berlin: Georg Bondi. 1899. Pages, 714.

This volume gives us a synopsis of the history of thought in Germany during the nineteenth century. Beginning with 1800 and having sketched the three world-views that were then struggling for supremacy, viz., the éclaircissement, classicism and romanticism, the author characterises Schelling's nature-philosophy and Hegel's phenomenology, which came to be the predominant systems of the first

half of our century. The author devotes two chapters to Prussia's political restoration during the wars against Napoleon I., and to the political reaction that set in in consequence of it. Hegel came partly as a completion of the reaction, partly as a hope for the liberal elements inaugurating the era of "Young Germany," whose leaders were Börne, Heine, Laube, and others. Next, we find Hengstenberg pitted against Strauss, a revival of orthodoxy and of an emboldened liberalism; this is the age which made it possible for a Feuerbach to teach his most radical views of religion from the philosophical chair of a German university. The reaction following after the revolution of 1848 swept all liberalism away, and culminated in the supremacy of such men as Stahl, ending in pessimism and finally finding an expression in the acceptance of Schopenhauer's philosophy. Then the cry was heard "Back to Kant," as if all these decades of philosophical evolution had been in vain.

Our author says little about German philosophy after the restoration of the empire, and devotes the last chapters (which treat of the time from 1871 up to the present year) to the socialistic movements of our age, the culture-combat between the empire and the Roman Church, the aspirations of socialism and the social democracy, and the various symptoms of decadence as seen in anti-Semitism, the agrarian movement, the philosophy of individualism as represented by Nietzsche and Stirner, anarchism, etc., winding up with an appreciation of the poetry of the present as it finds expression in Sudermann and Gerhart Hauptmann. Although there is reason enough in the present conditions of German thought to turn pessimist, Professor Ziegler confesses belonging to the optimists, and hopes that the German nation will work its way to freedom through all its political and religious aberrations. In this sense he congratulates the German nation on the great hopes with which it is now entering upon the twentieth century.

Thirteen well executed portraits, among them Goethe, Schleiermacher, Hegel, Strauss, Robert Mayer, Bismarck, Lassalle, Marx, and Nietzsche, form a welcome embellishment to the book; the paper is good and the print is clear. That the book has an index is very commendable, the more so as this is quite an exception in German works. KPS.

A HISTORY OF PHYSICS IN ITS ELEMENTARY BRANCHES INCLUDING THE EVOLUTION OF PHYSICAL LABORATORIES. By *Florian Cajori, Ph. D.*, Professor of Physics in Colorado College. New York: The Macmillan Company. London: Macmillan & Company, Ltd. 1899. Pages, viii, 322. Price, \$1.60.

Dr. Florian Cajori has followed up his *History of Mathematics* with a *History of Elementary Physics*. The success of the *History of Mathematics*, which despite its high price and the necessarily limited circulation of such books has been a considerable one, is ample evidence of the appreciation which now generally obtains of the value of historical instruction in science. As in his *History of Math-*

ematics, so here Professor Cajori has interwoven a goodly amount of attractive biographical material into his expositions, which have not suffered thereby. The treatment of each subject is in periods and by centuries. The human interest of the book might have been even more enhanced, had Professor Cajori made use of a greater number of such illustrations as he has put into the first part of his book, and which exist in great profusion in physical literature—illustrations of the character of those used by Dahlmann in his German book of extracts from the great masterpieces of science (Engelmann, Leipsic). But the addition would probably have increased the bulk of the book beyond the author's and publishers' desire.

The chapter on the "Evolution of Physical Laboratories" is good. It is little known that the main great discoveries of physics, until very recently, were made in private homes entirely at private expense. "We know that Dulong expended nearly all his wealth on apparatus. Fresnel conducted his immortal experiments privately, and defrayed from his own resources the heavy expense for apparatus. "Foucault carried on most of his experiments at his own residence. On one occasion savants flocked to the humble abode of Ampère in the Rue Fossés Saint Victor to see a platinum wire, as soon as it was traversed by an electric current, "set itself across the meridian.

"Bernard, that prince of experimenters, worked in a damp, small cellar, one of those wretched Parisian substitutes for a laboratory which he has called 'the tomb of scientific investigators.' Gay-Lussac's laboratory was on the ground floor and, to protect himself from the dampness, he wore wooden shoes." Now we have such magnificent temples of science as the great laboratory at Zürich, which cost three million francs.

The wealth of enlightenment and inspiration, too, that lies in the contemplation of the history of the great discoveries, furnishing arguments and illustrations quite applicable to the conditions to-day in other fields, may be seen from the following anecdote from Galileo's career. It was just after Galileo's discovery of the sun-spots. "His observations seemed to confirm the Copernican theory. The cloud of opposition to Galileo began to gather. Some refused to believe their eyes, and asserted that, while the telescope answered well enough for terrestrial objects, it was false and illusory when pointed at celestial bodies. Others refused to look through it. Among the latter was a university professor. Galileo wrote to Kepler: 'Oh, my dear Kepler, how I wish that we could have one hearty laugh together! Here, at Padua, is the principal professor of philosophy, whom I have repeatedly and urgently requested to look at the moon and planets through my glass, which he pertinaciously refuses to do. Why are you not here? What shouts of laughter we should have at this glorious folly! And to hear the professor of philosophy at Pisa laboring before the Grand Duke with logical arguments, as if with magical incantations to charm the new planets out of the sky.' The antagonism to Galileo and his hated telescope became stronger. The clergy began to denounce him and his methods. Father Caccini became known as a

"punster by preaching a sermon from the text, 'Ye men of Galilee, why stand ye gazing up into heaven?'"

Upon the whole, Dr. Cajori has produced a book that was needed, and as a handy manual of reference for the main historical facts of physics it will discharge a distinct service in our academic and high-school libraries as well as in the hands of individual students who have not access to foreign literature. *uKPK.*

TRAITÉ ÉLÉMENTAIRE DE MÉCANIQUE CHIMIQUE FONDÉ SUR LA THERMODYNAMIQUE.

By *P. Duhem*, Professeur de physique théorique à l'université de Bordeaux.

Tome IV. *Les Mélanges doubles. Statique chimique générale des systèmes hétérogènes.* Paris: A. Hermann. 1899. Pages, 381.

Duhem's *Treatise on Physical Chemistry* is well known to the readers of *The Monist* through three previous reviews, and the reputation of the work is such that but brief reference is necessary to the contents of the present fourth and last volume. It is divided into two books treating of double mixtures and the general chemical statics of heterogeneous systems. In the first of these books the theory of distillation, the critical stages of mixtures, the liquefaction of gaseous mixtures, etc., are treated; in the second book the general principles of the chemical statics of heterogeneous systems under constant pressure, the general theorems relating to univariance and bivariance, and the general principles of the statical chemics of heterogeneous systems at constant volume, are given. The work contains an index of authors and of the chemical substances studied in the four volumes constituting it, and a glance at this index will show the scope and completeness of this first systematic work on mathematical chemistry.

LEÇONS NOUVELLES SUR LES APPLICATIONS GÉOMÉTRIQUES DU CALCUL DIFFÉRENTIEL.

By *W. de Tannenberg*, Professeur à la Faculté des Sciences de l'Université de Bordeaux. Paris: A. Hermann. 1899. Pages, 192.

The present volume is another indication of the activity prevailing at the University of Bordeaux in the department of science. The book is not a large one, but it expounds the chief methods of applying the Differential Calculus to geometry, from clear and partly novel points of view. It is divided into five parts, treating of the descriptive properties of lines, the descriptive properties of surfaces, the metrical properties of lines, the metrical properties of ruled surfaces, and the metrical properties of curved surfaces, respectively. The typography of the book is pleasing, and in the same style as the other mathematical books of Hermann.

DE L'INFLUENCE DE LA PRESSION SUR LES ACTIONS CHIMIQUES. By *Georges Aimé* (1837). Avec une introduction par *P. Duhem*. Paris: A. Hermann. 1899. Pages, 32.

The above title is that of a thesis for the doctorate, written in 1837 by Georges Aimé, of Metz. It has been deemed worthy of reprinting by the Scientific Society

of Bordeaux, and has been supplied with an introduction by Professor Duhem, who regards it as an extremely important document in the history of science, in that it shows for the first time that the "tension of dissociation" has the same value in an inert gas as in a vacuum, and is thus a justification of the postulate upon which the theory of Gibbs rests. Sainte-Claire Deville, who was the first to have promulgated the "theory of tension of dissociation" (1863), was ignorant of the results of Aimé.

LEÇONS DE CHIMIE PHYSIQUE PROFESSÉES A L'UNIVERSITÉ DE BERLIN. By *J. H. Van't Hoff*. Traduit de l'Allemand par *M. Corvisy*, Professeur agrégé au Lycée de Saint-Omer. Deuxième partie. La statique chimique. Paris: A. Hermann. 1899. Pages, 162.

"Chemical Statics" is the subject of the second part of Van't Hoff's work on physical chemistry. It is made up of lectures delivered in Berlin during the academic year of 1897 to 1898, and forms the second installment of a large, comprehensive work on physical chemistry. But it may be considered as an independent work, treating of the methods to which we owe the knowledge we now possess regarding the size, structure and grouping of molecules, and from which has sprung the modern scientific conception of the constitution of matter. The theory of solutions and stereo-chemistry have received adequate consideration. The present second part of Van't Hoff's work has not yet been translated into English, and M. Corvisy's French translation may in the meantime be of considerable service to readers not acquainted with German.

INSTINCT AND REASON. An Essay Concerning the Relation of Instinct to Reason, with some Special Study of the Nature of Religion. By *Henry Rutgers Marshall, M. A.* New York: The Macmillan Co. 1898. Pages, xiii, 574. Price, \$3.50.

The main subject of the present work is the study of religion. The study of instinct and reason forms merely a condition precedent to a comprehension of the religious problem proper. "It has long seemed to me evident," says the author, "that activities which are so universal in man as are those which express our religious life, cannot fail to be of significance in relation to our biological development, especially as these activities have persisted for so many ages in the human race. I have, therefore, attempted to outline a theory which will account for the existence of religious activities, and which will explain their biological import."

It will be unnecessary for us to follow Mr. Marshall into the intricacies of the psychological development upon which he has based his theory, except to say that instinct appears to him "as a mode of that simplest of all phenomena of activity—the reaction of a living cell to the stimulus from its environment." Instinct con-

stitutes the typical organic process; reason and choice constitute the variant process in organic life. Instinct and reason "are but aspects of the basic tendency to "the persistence of life; they appear in opposition because we look only at complex organic forms, while the tendency to strive for persistence of life is fundamentally *elemental*, only secondarily relating to more or less integrated aggregates of elements, with which, in more or less complex organic form, biology has "to deal."

As to the formulation of the rule of conduct, which is in harmony with the psychological considerations advanced, it is maintained that "the important consideration in the guidance of our lives is attention to, and the strengthening of, "the more far-reaching and pervasive and persistent, although often less emphatic, "impulses within us; and that this is necessary if we are to become efficient individuals in the racial group to which we belong, and which we hope will persist "and develop in the future." The method of ensuring our conduct under this rule is "by the restraint of those instincts which are wont to be stimulated to vigorous and immediate reaction, by the restraint of the variations which are determined by rationalistic emphasis, until such time as those more pervasive instincts "that are not wont to be stimulated to vigorous and immediate reaction have time "to assert themselves and to gain due prominence in the determination of our action. . . . So soon as this habit of restraint in this manner becomes instinctive, "then, as we have argued above, we find ourselves governed by the religious instinct within us, then we find our trends of action determined not only by the "simple conscience which balances particular impulses, but by that wider development of conscience which teaches us to emphasise habitually the most permanent "order of impulse-efficiencies of which we can conceive; then, in other words, we "find ourselves guided by the 'sense of duty.'" Accordingly, the rule of action which best satisfies conscience and produces the closest correspondence between our actions as viewed in retrospect, and our most permanently efficient impulse-series, is formulated as follows: "Act to restrain the impulses which demand immediate reaction, in order that the impulse order determined by the existence of impulses of less strength, but of wider significance, may have full weight in the guidance of your life." "In other words"—and this sentence, heavily capitalised, concludes the work—"BE RELIGIOUS."

THE GROUNDWORK OF SCIENCE. A Study of Epistemology. By *St. George Mivart*.

M. D., Ph. D., F. R. S. New York: G. P. Putnam's Sons. London: Bliss, Sands & Co. 1898. Pages, xvii, 328. Price, \$1.75.

The announcement of a book on the groundwork of science by a natural inquirer of the standing of St. George Mivart, is well calculated to arouse the expectancy of students of epistemology; but it can scarcely be said that the hopes which would naturally be associated with such a publication have been realised. Instead of an investigation of the principles and methods which form the real difficulties of

the subject, we are confronted with little more than a bare recital of the banal theories of the traditional philosophical moralising. It is remarked, for example, as a result of one special inquiry, that the groundwork of science must be sought in the human mind (as if any one could imagine it to be elsewhere), and that the objects of science are threefold: mental, physical, and metaphysical. The work abounds with like trivial conclusions and commonplaces. In the chapter on the methods of science the assumptions implied in scientific research are said to be as follows: (1) That certain knowledge is possible; (2) that an external objective world exists; (3) that we can know not only our actions, sensations, etc., but also our substantial and continuous personal existence; (4) that if certain premisses be true, whatever follows from them logically must be also true; (5) since we know certain truths indirectly by inference we must also know some things indirectly, and see that they are self-evident; (6) that nothing can at the same time both be and not be; (7) that some axioms are self-evident; (8) that every change must be due to some cause; (9) that nature is uniform; and (10) that some things are necessary, others are contingent. To the person who has given the least thought to that department of philosophy which is called the theory of knowledge, it must appear that it is precisely these so-called assumptions that require elucidation, and that it is nothing less than the object of epistemology to elucidate them. The thinking world is pretty clear as to the implications of the scientific method generally, and it is rather as to the justification and establishment of these implications that they are seeking light. The same remark applies to the crowning conclusions of Dr. Mivart's researches, viz., that the "groundwork of science" will be found to consist of three divisions: the laborers who work, the tools they must employ, and that which constitutes the field of their labor. There is scarcely any one who will deny the truth of this statement, and it would hardly seem that a work of over three hundred pages should be required to demonstrate it.

We should be far from saying that Dr. Mivart has not written a readable book and that there are not many valuable pages of descriptive matter and of general considerations touching the external mechanism of scientific method. All these things it is well to have, and their worth is enhanced by the fact that they come from a scientist who is a professing Roman Catholic, and that we may here see to what length it is permissible to carry the conclusions of reason within the fold of the Roman Church.

The titles of the main chapters of the book are: An Enumeration of the Sciences, The Objects of Science, The Methods of Science, The Physical Antecedents of Science, The Psychical Antecedents of Science, Language and Science, Intellectual Antecedents of Science, Causes of Scientific Knowledge, and The Nature of the Groundwork of Science.

It remains for us merely to quote the concluding remarks of the author: "We "feel bound to confess that the more we study nature, the more profoundly con- "vinced do we become that the action of an all-pervading but unimaginable intel-

"ligence alone affords us any satisfactory conception of the universe, as a whole, "or of any single portion of the cosmos which may be selected for exclusive study.

"Unless we are profoundly mistaken, it is only through the conception of such "an energy, as an active causative principle, underlying and pervading the mate- "rial cosmos, together with the recognition of the dignity of human reason, em- "powered as it is to perceive self-evident, universal, and objective truths, that we "can understand the groundwork of science and attain to a final and satisfactory "Epistemology."

L'ESIGLIO DI S. AGOSTINO. Note sulle contraddizioni di un Sistema di Filosofia per Decreto. By *Lorenzo Michelangelo Billia*. Turin: Fratelli Bocca. 1899. Octavo, pages, xi+148. Price, L. 3.

This book was occasioned by Professor De Craene's volume on *De la spiritualité de l'âme*. It is a metaphysical discussion of various questions relating to the philosophy of the Thomist school and of materialism. While not polemical, the book defends philosophic idealism. The supreme thought of the author is the Christian philosophy. The more philosophy becomes Christian, he says, the more it is philosophy, and Christianity is more philosophic the more it is sincere and entire. The author deprecates the present condition of the school in regard to the teaching of religion. Those who would take God from the school, he declares, are enemies of the human race. Religion is not a complement of education, a part of it, like other branches of learning, it is education itself. There is no true education that is not religious. Such is the conclusion of the author after a series of metaphysical discussions which take the reader back among the scholastics and leave him there.

THE DYNAMICS OF MIND. By *Rajkumar Banerji, M. A.* Part the First. Calcutta: Mitter Brothers. Bhowanipur. 1899. Pages, 46. Price, rs. 6d.

Rajkumar Banerji, an Indian savant, publishes in the Indian Philosophical Series, No. 1, which is just out, a thoughtful monograph on *The Dynamics of the Mind*. It is based on the proposition that "mind is motion," and tries to explain mental activity from the laws of motion. It cleverly introduces modern theories of elasticity, postulates a thought-field analogous to the magnetic field, and also speaks of thought-induction, the transmission of thought-waves, convertibility of thought-waves, etc., etc. Sir William Crooke's ideas and also Thomson and Tait's theories are utilised in the interest of a mechanical explanation of thought transference.

As to the value of these speculations, we have to say that they are more ingenious than verifiable. They collide with the main facts as to the nature of the soul, which does not consist of motion but is the significance of a certain form of motion. The nature of mind does not consist in thought waves which can be treated like electric waves, but in the representativeness of certain feelings. Thus, it is obvious that the treatise of Rajkumar Banerji is based on premisses, which, accord-

ing to our views, are radically erroneous; but for all that we cannot help being interested in the author's attempts, which are cleverly made, and indicate not only a versatility of mind but also a pretty thorough acquaintance with mechanical and electrical science.

ENGLISH POLITICAL PHILOSOPHY FROM HOBSES TO MAINE. By *William Graham, M. A., Professor of Jurisprudence and Political Economy at Queen's College, Belfast.* London: Edward Arnold. 1899. Pages, xxx, 415. Price, 12s.

The design of Professor Graham's work, which immediately engages one's attention by the erudition which it displays and the clearness of its expositions, is twofold: (1) that of giving a connected account of the political theories of the greater English political thinkers that have most influenced practice from the days of Hobbes, and (2) to disengage by the use of criticism the permanent elements of political theory from the erroneous doctrines which have been virtually eliminated by history. His method is that of a combination of the old deductive and the new historical methods. The political thinkers whose systems he expounds are Hobbes, Locke, Burke, Bentham, John Stuart Mill, and Maine. While the book is addressed to ordinary students of political philosophy, it will be especially appreciated, the author believes, by serious students of maturer years who are acquainted with his work on *Socialism*.

ETHICS AND REVELATION. By *Henry S. Nash, Professor in the Episcopal Theological School at Cambridge.* New York: The Macmillan Company. 1899. Pages, vi, 277. Price, \$1.50.

The present volume is a collection of lectures delivered by Professor Nash in Philadelphia, under the auspices of the Church of Holy Trinity, the officers of which are the trustees of the John Bohlen Lectureship,—a lectureship modelled upon the Bampton Lectureship of Oxford, England. The object of the lectureship is the apology of the Christian religion, and the aim of the lectures of Professor Nash has been "to show that the Bible marks out the road along which conscience must travel, if it would treat our life on earth with abiding seriousness." Professor Nash adopts the view that the higher criticism, despite the many sins it has to answer for, has placed the question of biblical religion, and the dogmatic theories with which it has been historically connected, upon an entirely new footing. But the views of Professor Nash on the main problems of Christian dogmatics will be found to be quite orthodox.

CLEMENS ALEXANDRINUS UND DAS NEUE TESTAMENT. Eine Untersuchung. By *Hermann Kutter.* Giessen: J. Ricker'sche Buchhandlung. 1897. Pages, iv, 152.

The common opinion concerning Clement of Alexandria is that he does not distinguish between the canonical and Apocryphal writings of the New Testament,

and that therefore as late as in his age the Christian canon was not yet established. Our author, the Rev. Hermann Kutter, proposes to re-establish the old view that the canon was established at that time, because Clement, after all, distinguishes between reliable Christian writings and those which he uses only to refute heretical doctrines. Our author grants that Clement did not as yet know a canon in the sense in which the term is at present accepted, but he shows a discrimination as to the value of his sources, and relies on them as an authority only if they belong to what he calls "the Lord's writings" (*γραφαὶ κυριακαῖ*).

It is difficult to say whether the defence of the old position is better or worse than the view of the critics so called, for the Rev. Mr. Kutter takes pains to explain the carelessness of Clement, his lack of criticism, and his confusion (*Zerfahrenheit*). Clement in quoting passages, is in the habit of "volatilising their sense whenever it suits him" (*wenn es ihm gerade passt*). Under these circumstances, the Rev. Mr. Kutter argues, judging from the character of his writings, Clement may have expressed himself without precision and yet have adhered to a definite ideal of true Christianity. He quoted "the gospel of the Egyptians" only through the imputation of heretics, and had probably not read it himself. This is quite probable, but we may just as well say that a definite conception of Christianity became established and thus paved the way for a final settlement of the canon.

One of the chief merits of Clement, according to Mr. Kutter, is that to him the revelation was closed. The Old and the New Testament had found their perfection in the past, and he recognises the difference between his own time and the Apostolic age.

Thus, while he relies on tradition, and does not mean to separate tradition from Scripture, God's salvation is to him a fact which has been completed in the past.

DIE MODERNE PHYSIOLOGISCHE PSYCHOLOGIE IN DEUTSCHLAND. Eine historisch-kritische Untersuchung mit besonderer Berücksichtigung des Problems der Aufmerksamkeit. Von *W. Heinrich*. Zweite Ausgabe. Zürich: E. Speidel. 1899. Pages, vii, 249. Price, M. 4.

ZUR PRINZIPIENFRAGE DER PSYCHOLOGIE. Von *W. Heinrich*. Zürich: E. Speidel. 1899. Pages, 74. Price, M. 2.

Professor *W. Heinrich*, of the Physical Institute of Krakau, passes in review in the first of these pamphlets a number of psychological authors who have been or are still before the public, and whose views form the subject-matter of psychology to-day; such men as Fechner, Helmholtz, G. E. Müller, Wundt, Lange, Kölpe, Münsterberg, Ziehen, Avenarius, and Exner. We are sorry not to find among them Prof. Ernst Mach, whose views deserve to be mentioned as much as those of any one of the above, and since Mach is a physicist like the author he should have been mentioned by Professor Heinrich. It goes without saying that being exclu-

sively under the influence of German philosophy, English and American psychologists are entirely neglected.

Professor Heinrich is critical and thoughtful, and his views upon the whole are sound. He takes the monistic standpoint and adopts the parallelism of psychic and physiological processes. In his second pamphlet, where he proposes to discuss the question of principle in psychology, he is most explicit in rejecting dualism in any form that might be understood as a causation in contradiction to physical causation. He says on page 17: "We cannot escape the conclusion of a perfect interdependence of the psychical and the physical which is not disturbed by the fact that on both sides of our synthesis heterogeneous elements appear whose elements offer qualitatively different results."

The world may not know that Krakau has a physical institute, and we are glad to receive a symptom of intellectual life so full of promise from these quarters of Europe, which have so far not as yet been mentioned in the history of psychology.

KPC.

BRAIN IN RELATION TO MIND. By *J. Sanderson Christison, M. D.* Chicago. 1899. Pages, 143. Price, \$1. 25.

Dr. Christison, who served as an expert in several sensational law suits before the bar of Chicago, and may be remembered by our readers as the author of *Crime and Criminals*, which was reviewed in our columns at the time of its appearance, has prepared a synopsis of the physiology of the brain in its relation to mind which is very readable and instructive to the general public. It contains an interesting collection of analyses of cases which would go far to prove that mind should not be identified with brain-action; but we have to emphasise that Dr. Christison goes a little too far in his theory of the independence of mind. He should consider that in all the cases of loss of brain-substance, one of the hemispheres only was injured. As to the brainless dog of Professor Goltz, we have to say that this famous creature did not "exhibit defects only in the manifestation of intelligence, memory, reflexion, and understanding," but he was a perfect idiot of a dog and showed no signs of intelligence; he was, as Professor Goltz expressed it himself, a living and eating reflex mechanism; he was a living animal, performing all the functions of animal life without any intelligence whatever. Professor Goltz's own statements are perhaps misleading and in addition it must be granted that in the course of further life he developed memory again, but even that was insignificant, and the dog continued to give the impression of a soul-dumb animal. As the reviewer has himself seen the dog, shown by Professor Goltz, he could form his own opinion on this point.

While Dr. Christison seems to believe that soul-activity is possible without the corresponding brain-commotion, we would say that much intelligence is left even after the removal of great quantities of brain-substance, if only some parts of the brain-substance able to perform the work are left. Nature apparently has been

very generous in furnishing man with a good supply of brain-matter; and in fact brain-diseases and nervous diseases are comparatively more rare than might be anticipated. Nervous tissues are very tenacious and more reliable in their work than other organs; but there is no argument in favor of the theory that in the absence of all brain-matter the mind would be able to continue its work. If Dr. Christison modified his views to say that the methods of many modern criminologists are based upon a wrong materialism, that the shape of the head and other bodily symptoms are worthless in a consideration of a man's character and moral qualities, we would heartily agree with him.

In spite of the shortcomings of the book, it is very readable and can be heartily recommended.

SAGGI SULLA TEORIA DELLA CONOSCENZA. Saggio primo sui limiti e l'oggetto della conoscenza a priori. By *Cosmo Guastella*. Palermo: Remo Sandron. 1898. 12 mo. Pages, 570.

The nature of this book may best be indicated by its contents. They are as follows: Hypotheses in regard to concepts, classification of judgments, judgments a priori and judgments a posteriori, analytical doctrine of judgments a priori, doctrine of Kant on synthetic judgments a priori, an examination of mathematical and other less important classes of propositions a priori, doctrine of the empirical philosophers on necessary truth, psychological foundation of necessity and the a priori character of judgments on resemblance, and finally the inconceivability of the negative and the universal postulate. The author strives to follow closely the scientific method and in this volume, which is to be followed by others, he arrives at the conclusion that all affirmations in regard to an existence beyond phenomena are insupportable. Such an existence, he says, could not be proven by experience which is itself limited to phenomena; nor could it be arrived at intuitively or deduced a priori, because, in reality, existence could not be the object of knowledge a priori. Such a conclusion is not fatal to the lofty aspirations to our intelligence for, he says, there is no reason why we should pass beyond the knowable. The knowledge which we may attain to, he asserts, is complete and absolute. "In phenomena which are the only *things* of which we may affirm the existence there is nothing to know other than the regular order with which they present themselves, their constant sequence—and this is the only *causality* which we have the right to admit; now we may know these sequences and this order; human knowledge is therefore, virtually unlimited."

LA DOTTRINA DELL'INTELLETTO IN ARISTOTLE e nei suoi piu illustri interpreti. Opera premiata dalla R. Accademia dei Lincei. By *Romualdo Bobba*. Turin: Carlo Clausen. Pages, 479.

The book is divided into two parts. The first takes up the doctrine of the νοῦς πονηροῦ and νοῦς πεπηρυτοῦ as a result of the writings of Aristotle, the logical

genesis of this theory in the mind of Aristotle with the historical reasons and the subjective impulses which explain his oscillations and contradictions and the relations which unite the doctrine of the *νοῦς* with the other parts of the Aristotelian philosophy and the determination of its meaning and value. In the second part the author gives us an interpretation of the *νοῦς πολιτείας* and *παθητικός* of the immediate disciples of Aristotle and of his Greek commentators. Chapters are devoted also to the Arab and scholastic commentators of Aristotle and to the principal Italian commentators of the Renaissance. The principal historians and commentators of the past century and of the present century down to our day also receive some attention. The concluding part of the volume takes up the excellences and defects of the investigations of Aristotle in relation to his psychological and general doctrine and to contemporaneous philosophy. The author in treating the much debated problem of knowledge claims to have added a valuable contribution to the history of philosophy by showing those parts of the Aristotelian doctrine which ought to be preserved and perfected and those which should be eliminated.

GIAMBATTISTA VICO E I SUOI CRITICI CATTOLICI. Con osservazioni comparative su gli studi religiosi dei secoli xviii e xix. Ricerca storica. By *Baldassare Labanca*, Professore della Università di Roma. Naples: Luigi Piero, Tip. editore. 1898. Pages, vii+453.

In one of Vico's letters he refers to certain Catholic critics by whom, under the guise of religion, he was harrassed, and who sought to ruin him and all others who discovered new truths. This letter furnished the author of the present work a hint which he has carefully followed up in a study of the various critics of the famous Italian thinker. The starting-point of our author's investigations was an old book which he accidentally came across in Rome entitled "An Apology of the Human Race on Being Accused of Having Been at one Time a Beast." This book, after some investigation made necessary by its incomplete condition, is assigned to Finetti who wrote in 1764. This apology, says the author, was the occasion of the present work. He finds in it many anticipations of modern criticism of the *Scienza nuova*. Among the critics of Vico, to whom attention is given, besides Finetti, are: Romano, Lani and Duni. The metaphysics of Vico and his religious doctrines, both in relation to those of our present time and as they appeared to some independent critics, are considered at some length. One chapter is devoted to a glance at other religious doctrines of the Italians in the eighteenth century. The author has performed a scholarly piece of work and gives us a book which is indispensable to a thorough study of Vico.